

APPENDIX E

Potable and Wastewater Treatment Facilities

Lower West Coast Water Supply Plan -- Appendix E

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POTABLE WATER TREATMENT FACILITIES

Most potable water used in the Lower West Coast (LWC) Planning Area is processed by both large and small water treatment facilities. This section will focus on the larger and/or regional facilities because they are large enough to have an impact on the water resource. There are 29 existing large and/or regional facilities.

These water treatment facilities and proposed/future facilities are located mainly in the urbanized areas throughout the LWC Planning Area, as indicated on Figure E-1 and its corresponding key (Figure E-1a). More than half of the facilities are privately owned. Lime softening is utilized at 25 of the facilities, while membrane technology and/or electrodialysis is implemented at four of the facilities, and aeration only at one other. The total treatment capacity of these facilities is 135.99 million gallons per day (MGD), of which there was a 1990 average annual demand of 79.61 MGD. Key information for each utility is summarized in Table E-1.

Summary descriptions for each of the water treatment facilities located in the LWC Planning Area, are presented in this section. Each utility capsule contains the following information:

Raw Water Supply - This section states the SFWMD permit number with the issue and expiration dates, a summary of withdrawal facilities, and the SFWMD approved allocations. All well depths are measured from land surface.

Treatment Method - This section presents the Florida Department of Environmental Regulation (FDER) rated capacity, the method of treatment, the location of the treatment plant, and the 1990 average daily flow. The concentrate/brine reject disposal method, if a membrane or electrodialysis (ED) technology is used for treatment, is also provided.

In July 1993, the FDER was merged with the Florida Department of Natural Resources (FDNR) to form the Florida Department of Environmental Protection (FDEP). However, this appendix refers to the FDER because most of the utility data was collected prior to the merger.

Interconnections - This section describes water distribution system interconnections with other potable water distribution systems.

Proposed - This section states any current construction or permitting that is underway.

Future - This section presents projected utility flows (as provided by the utility) and known future treatment plant expansions and plans, including additional facilities and wellfields.

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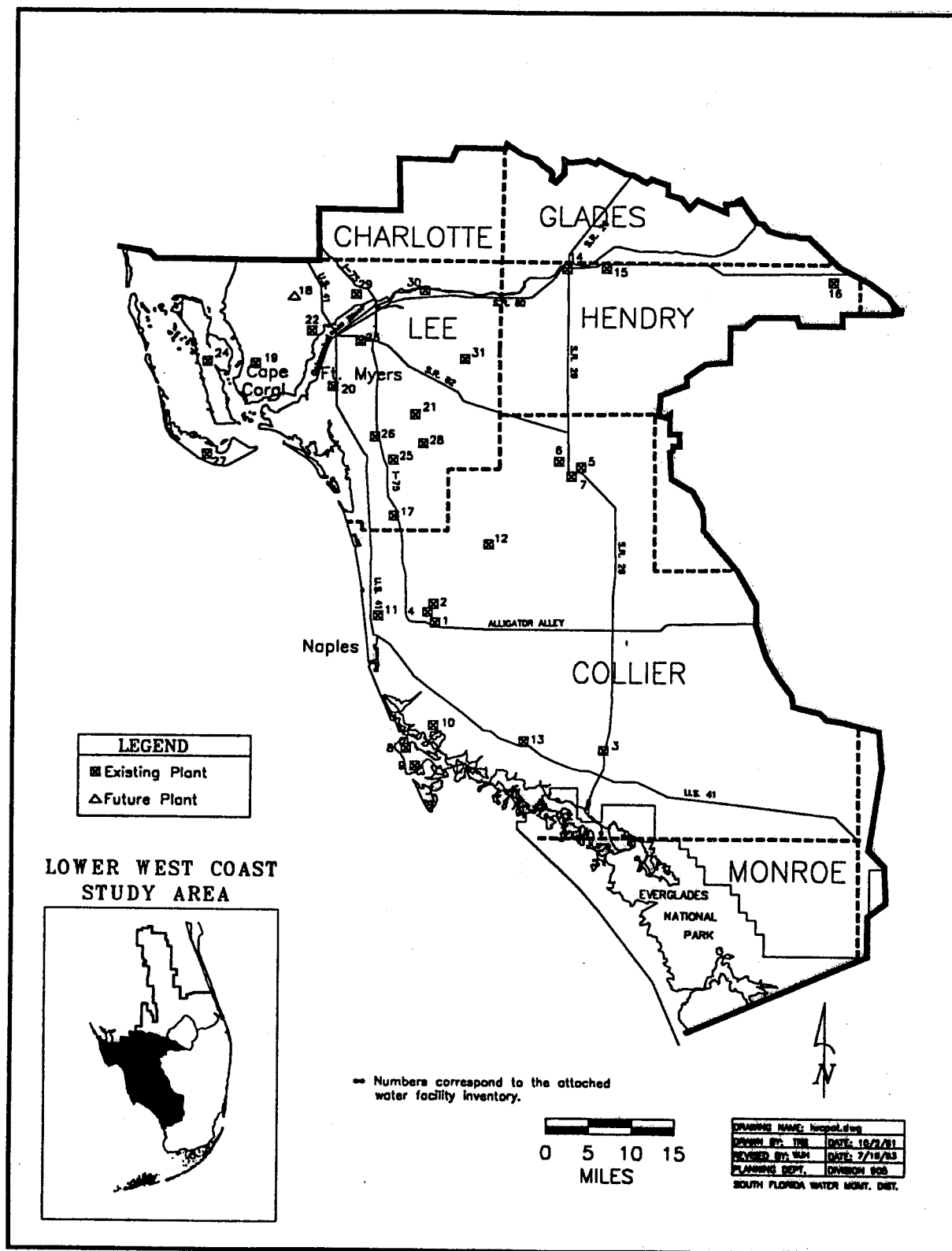


FIGURE E-1. Potable Water Treatment Facilities in the LWC Planning Area.

Lower West Coast Potable Water Treatment Plants

<u>Map Number</u>	<u>Facility</u>
Collier County	
1	Collier County Utilities (Golden Gate)
2	Collier County Utilities (North Naples)
3	Everglades City
4	Florida Cities Golden Gate
5	Immokalee Airport
6	Immokalee Carson Road
7	Immokalee Main
8	Marco Island (Lime softening facility)
9	Marco Island (RO facility - Unit 25 site)
10	Marco Shores
11	Naples
12	Orangetree
13	Port of the Islands
Hendry County	
14	La Belle
15	Port La Belle
16	U.S. Sugar
Lee County	
17	Bonita Springs
18	Cape Coral North
19	Cape Coral South
20	Florida Cities College Parkway
21	Florida Cities Green Meadows
22	Florida Cities Waterway
23	Fort Myers (Arcadia Street)
24	Greater Pine Island
25	Gulf Utility Corkscrew
26	Gulf Utility San Carlos
27	Island Water Association
28	Lee County Corkscrew
29	Lee County North
30	Lee County Olga
31	Lehigh Utilities

FIGURE E-1a. Key to Potable Water Treatment Facilities Map.

TABLE E-1. Potable Water Treatment Facilities in the LWC Planning Area.

Facility	FDER Rated Capacity (MGD)	1990 Average Daily Flow (MGD)	Method of Treatment			SFWRD Permit Number	Approved Annual Allocation (MGD)	Raw Water Source				
			Time Softening	Membrane Technology	Aeration			Water Table	Lower Tamiami	Sand-stone	Mid-Hawthorn	Floridan
Collier County												
Collier County Util.	24.00	10.18	X	X		11-00249-W	18.80		X			
Everglades City	0.86	0.10	X			11-00160-W	0.12	X				
FL Cities Golden Gate	1.22	0.86	X			11-00148-W	1.68	X				
Immokalee	1.25	2.50	X			11-00013-W	3.13		X	X		
Carson Road	0.75	b	X				a		X			
Airport WTP	1.00	b	X				a		X			
Marco Island Util.	8.00	5.45	X	X		11-00080-W	7.00					X
Marco Shores	0.72	0.13	X			11-00080-W	a					X
Naples	30.00	17.35	X			11-00017-W	16.46		X			
North Naples	0.75	0.15	X			11-00193-W	0.95	X				
Orangetree Utilities	0.43	0.01	X			11-00419-W	0.44		X			
Port of the Islands	0.39	0.14	X			11-00271-W	0.29				X	
Hendry County												
Labelle	1.50	0.53	X			26-00105-W	0.70	X				
Port Labelle	0.50	0.18	X			26-00096-W	0.27			X		
US Sugar	6.00	2.85	X			26-00024-W	3.23					X
Lee County												
Bonita Springs	6.00	2.15	X			36-00008-W	3.35		X			
Cape Coral	14.00	8.44		X		36-00046-W	11.59				X	
FL Cities College Park	1.50	0.51	X			36-00150-W	9.17				X	
FL Cities Green Meadows	9.00	5.19	X			36-00150-W	a	X		X		
FL Cit Waterway	1.50	0.90	X			36-00152-W	1.28	X			X	
Fort Myers	12.00	6.22	X	X		36-00035-W	8.92	X				X
Greater Pine Island	1.50	0.88	X	X		36-00045-W	1.31				X	
Gulf Util Corkscrew	0.50	c	X	X		36-00122-W	2.37	X		X		
Gulf Util San Carlos	2.50	1.46	X			36-00122-W	a	X				
Island Water Assoc	4.70	3.00		X		36-00034-W	4.08				X	
Lee County Corkscrew	10.00	5.56	X			36-00003-W	10.00	X		X		
Lee County North	0.20	0.00			X	36-00178-W	0.20			X	X	
Lee County Olga	5.00	3.32	X			36-00003-W	3.42					X
Lehigh Utilities	2.50	1.55	X			36-00166-W	2.08			X		

a- Allocation is incorporated into previous permit reference.

b- 1990 average daily flow totaled for Immokalee.

c- Facility recently placed in operation.

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COLLIER COUNTY

POTABLE WATER TREATMENT FACILITIES

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Collier County Utilities

SFWMD Permit Number: 11-00249-W
FDER PWS ID: 5114069

Raw Water Supply:

Raw water is withdrawn from 27 wells located in Golden Gate Estates along the Golden Gate Canal, between 7th Street and 2nd Street SE, and along Wilson Boulevard, between the Golden Gate Canal and 8th Avenue NE. The wells withdraw water from the lower Tamiami aquifer, are 12 and 16 inches in diameter, have total depths between 96 and 150 feet, and cased depths between 50 and 92 feet. The wells were drilled between 1983 and 1993. The wells have withdrawal capacities of 700 or a 1000 GPM. Specific well information is provided in Table E-2 and the location of the wells can be found in Figure E-2.

The current SFWMD permit was issued December 12, 1991 and expires December 12, 1996. The approved allocations are:

Annual Allocation	6.86 BGY (18.80 MGD)
Maximum Daily Allocation	31.77 MGD

The majority of the service area is in the Collier County reduced threshold area.

Treatment Method:

Treatment consists of a 12 MGD lime softening facility and a 12 MGD membrane softening facility. The 12 MGD lime softening plant is located in the NE quadrant of the intersection of County Road 951 and I-75 (Figure E-2). Based on some improvements, the FDER had approved a temporary upgrade to 16 MGD, until the membrane softening plant became operational. The 1990 average daily flow for this facility was 10.18 MGD with a maximum day flow of 13.89 MGD.

The 12 MGD membrane softening plant, completed and operational in the summer of 1993, is located in the vicinity of the intersection of Vanderbilt Road and County Road 951. The source water is from the existing wellfield, and concentrate disposal is by deep well injection.

Interconnections:

The distribution system has interconnects with the City of Naples at Pelican Bay, at the intersection of County Road 951 and Airport Road (12 inch), and at a location off Rattlesnake Road in East Naples (12 inch).

Proposed:

An aquifer storage and recovery project located at their Manatee Road finished water pump station has been completed by Collier County and is indicated on Figure E-2. The project will inject treated water into the lower Hawthorn aquifer during low demand periods and will be recovered to augment supplies during periods of high demand. A second ASR well is planned to be located at the membrane softening facility.

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Future:

It is anticipated 8 MGD of RO skids will be added to the membrane softening plant. Investigations are being conducted to identify potential saline ground water sources.

Source:

Information obtained from Collier County Utilities and SFWMD water use permit files.

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TABLE E-2. Collier County Utilities Potable Water Supply Wells.

Well Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Planar Coordinates	296720 E 684150 N	298020 E 684100 N	298987 E 684110 N	300500 E 683852 N	301927 E 683811 N	301241 E 684117 N	301238 E 685300 N	301242 E 686469 N	301201 E 687688 N	301192 E 688864 N	301230 E 689925 N	301187 E 691095 N	301210 E 692054 N	301194 E 693198 N
Status	Active	Active	Active	Active	Active	Standby	Standby	Standby	Active	Active	Active	Active	Active	Active
Aquifer	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami
Total Depth (ft)	96	100	100	102	108	101	106	106	114	112	137	133	130	131
Cased Depth (ft)	50	50	51	52	50	65	65	70	65	71	90	90	84	85
Well Diameter (in)	16	16	16	16	16	12	12	12	12	12	12	12	12	12
Pump Capacity (GPM)	700	700	700	700	700	700	700	700	700	700	700	700	700	700
Intake Depth (NGVD)	-35	-35	-35	-35	-35	-35	-35	-35	-35	-35	-35	-35	-35	-35
Year Drilled	1983	1983	1983	1983	1983	1987	1987	1987	1987	1987	1987	1987	1987	1987

TABLE E-2. (Continued).

Well Number	15	16	17	18	19	20	21	22	23	24	25	26	27
Planar Coordinates	301167 E 694102 N	301181 E 695091 N	303912 E 683875 N	305184 E 683839 N	307663 E 684366 N	307675 E 685586 N	301946 E 683010 N	301928 E 681865 N	301896 E 680723 N	301903 E 679820 N	301846 E 678787 N	302865 E 678538 N	304193 E 678570 N
Status	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Aquifer	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami
Total Depth (ft)	130	150	128	126	128	131	110	101	111	109	110	106	105
Cased Depth (ft)	84	92	78	80	83	83	62	62	59	58	65	65	61
Well Diameter (in)	12	12	12	12	12	12	12	12	12	12	12	12	12
Pump Capacity (GPM)	700	700	1,000	1,000	1,000	1,000	700	700	700	700	700	700	700
Intake Depth (NGVD)	-35	-35	--	--	--	--	--	--	--	--	--	--	--
Year Drilled	1987	1986	1991	1991	1991	1991	1993	1993	1993	1993	1993	1993	1993

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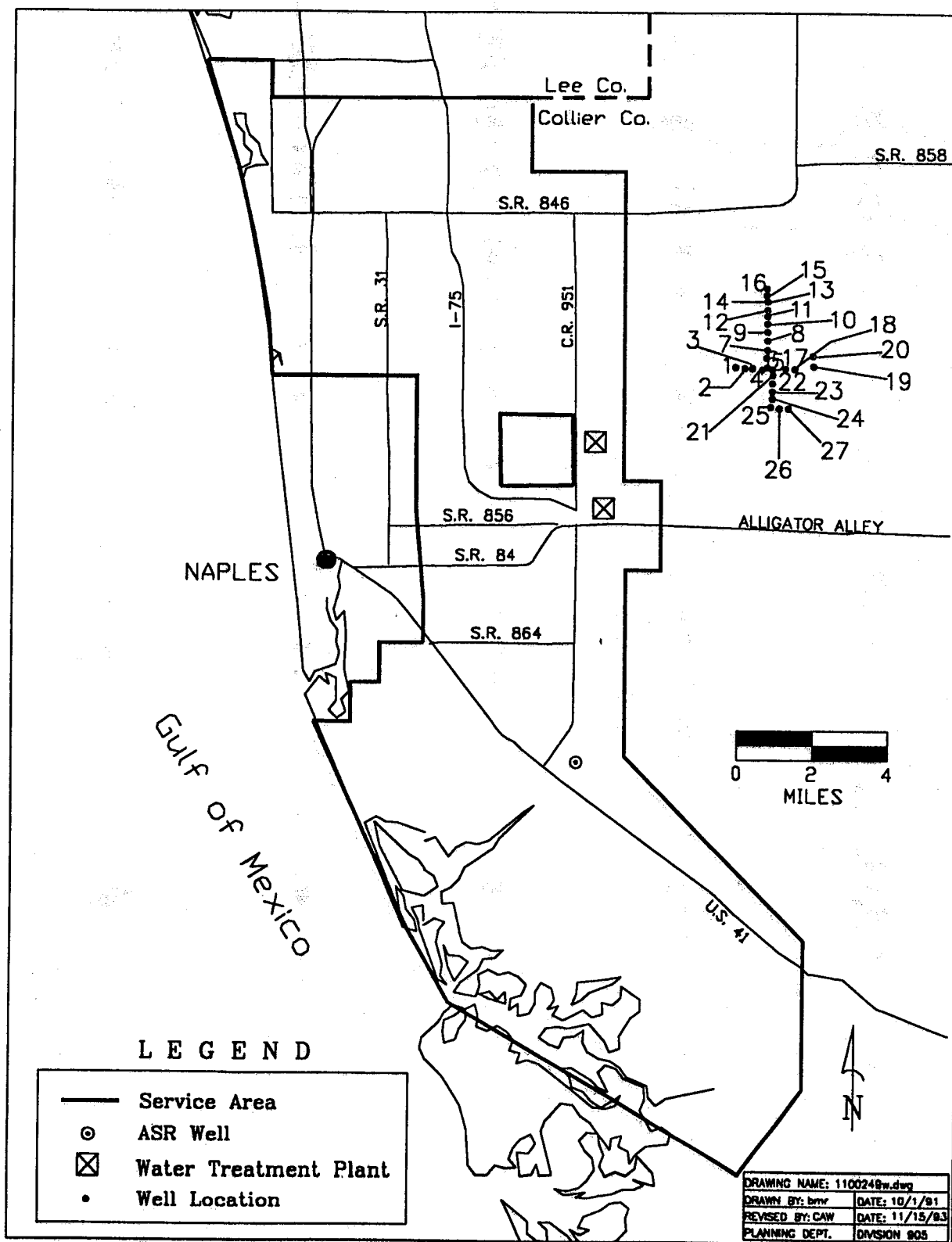


FIGURE E-2. Collier County Utilities Potable Water Supply Wells.

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Everglades City

SFWMD Permit Number: 11-00160-W
FDER PWS ID: 5110089

Raw Water Supply:

Raw water is withdrawn from three wells located in Copeland. The wells, which were drilled in 1982, withdraw water from the water table aquifer. The wells have total depths of 25 feet and cased depths of 15 feet. The designed pumpage for each well is 200 GPM. Specific well information is provided in Table E-3 and the location of the wells can be found in Figure E-3.

The current SFWMD permit was issued September 10, 1992 and expires September 10, 2002. The approved allocations are:

Annual Allocation:	44.00 MGY (0.12 MGD)
Maximum Daily Allocation:	0.30 MGD

Treatment Method:

Treatment is provided by a 0.86 MGD aeration facility. The facility is located on Jane's Scenic Drive in Copeland (Figure E-3), from which the treated water is pumped approximately seven miles to Everglades City. The 1990 average day flow was 0.10 MGD.

Interconnections:

There are no distribution interconnections with other utilities.

Proposed:

N/A

Future:

The Everglades City Comprehensive Plan estimates that the average potable water demand in the year 2000 will be 0.10 MGD, based on a per capita flow of 163 GPD. The existing demand is at this projected flow.

It is anticipated the service area will be expanded to serve the Chokoloskee Island.

Source:

Information was obtained from Everglades City and SFWMD water use permit files.

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TABLE E-3. Everglades City Potable Water Supply Wells.

Well Number	1	2	3
Planar Coordinates	381069 E 588666 N	380704 E 588667 N	380339 E 588668 N
Status	Active	Active	Active
Aquifer	Water Table	Water Table	Water Table
Total Depth (ft)	25	25	25
Cased Depth (ft)	15	15	15
Well Diameter (in)	8	8	8
Pump Capacity (GPM)	220	220	220
Intake Depth (NGVD)	-21	-21	-21
Year Drilled	1982	1982	1982

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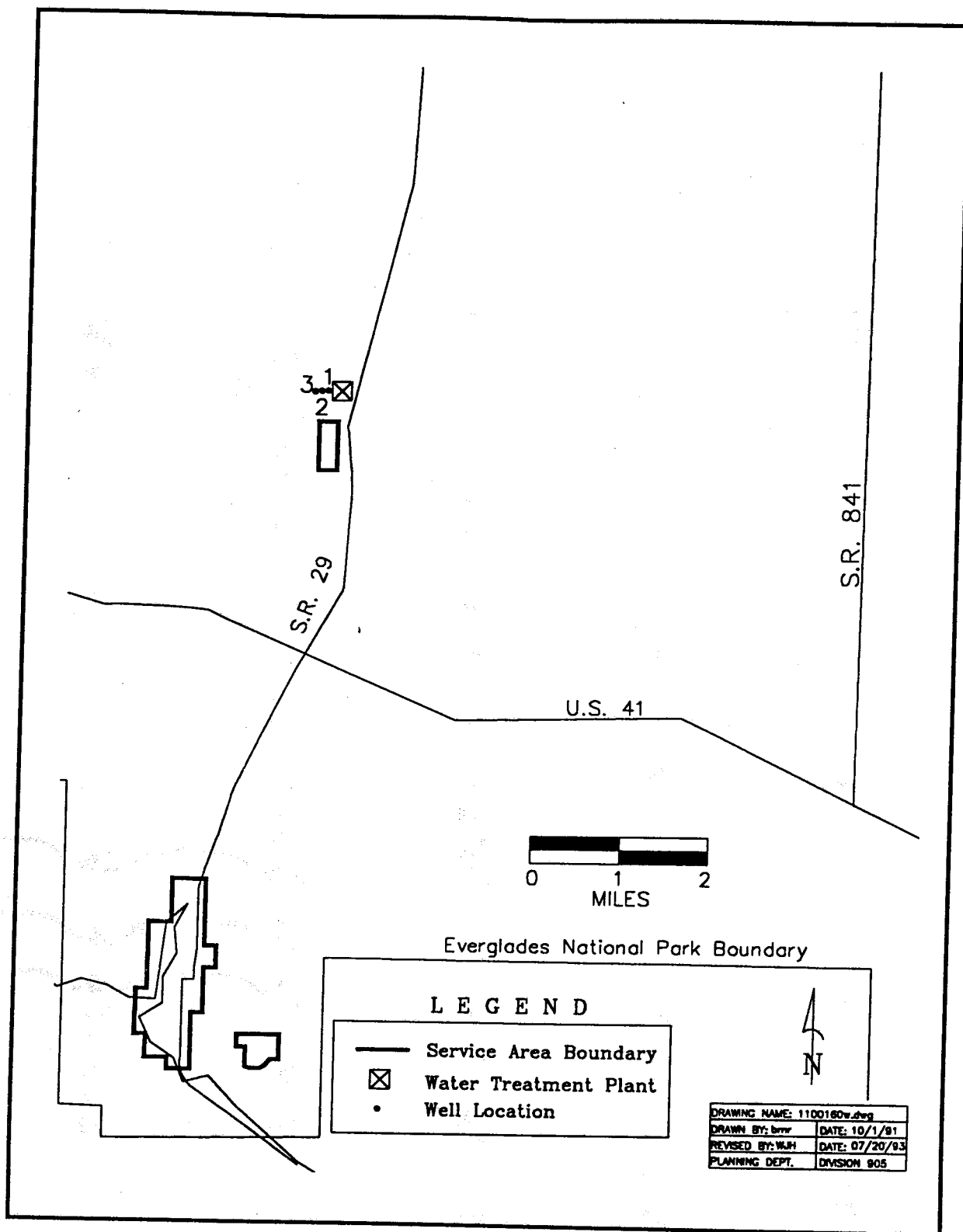


FIGURE E-3. Everglades City Potable Water Supply Wells.

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Florida Cities Golden Gate Estates

SFWMD Permit Number: 11-00148-W
FDER PWS ID: 5110117

Raw Water Supply:

Raw water is withdrawn from six wells located in the water treatment facility area. The wells withdraw water from the water table aquifer, are eight inches in diameter, have total depths between 22 and 45 feet, and cased depths between 15 and 25 feet. The wells were drilled between 1964 and 1989 and have pumping capacities between 75 and 250 GPM. Specific well information is provided in Table E-4 and the location of the wells are identified in Figure E-4.

The current SFWMD permit was issued January 14, 1993 and expires January 14, 2003. The approved allocations are:

Annual Allocation (All sources)*:	614.00 MGY (1.68 MGD)**
Maximum Daily Allocation:	2.29 MGD**

* This includes sources listed in the proposed section below

** The permit divides the allocation into water table and lower Tamiami; for the purpose of this plan, withdrawals are from the water table aquifer.

Treatment Method:

Treatment is provided by a 1.22 MGD (FDER rated capacity) lime softening treatment facility. This facility is located at Treatment Plant Road off of 44th Street SW, Golden Gate (Figure E-4). The 1990 average daily flow was 0.86 MGD, and the maximum day flow was 1.10 MGD.

Interconnections:

There are no interconnections with other potable water distribution systems.

Proposed:

The current consumptive use permit allows construction of three additional water table wells in the vicinity of the existing wells. Specific well information on the proposed wells is located in Table E-4 and the location of the wells are identified in Figure E-4.

Future:

N/A

Source:

Information was obtained from Florida Cities Water Company and SFWMD water use permit files.

TABLE E-4. Florida Cities Golden Gate Potable Water Supply Wells.

Well Number	1	2	3	4	5	8	9	10	11
Planar Coordinates	274023 E 672142 N	272034 E 671957 N	272602 E 672102 N	272435 E 672105 N	272435 E 672324 N	272597 E 671749 N	273553 E 672955 N	273781 E 672955 N	273987 E 672955 N
Status	Active	Active	Active	Active	Active	Active	Proposed	Proposed	Proposed
Aquifer	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Total Depth (ft)	22	22	45	45	22	22	25	25	25
Cased Depth (ft)	15	17	25	25	15	15	15	15	15
Well Diameter (in)	8	8	8	8	8	8	8	8	8
Pump Capacity (GPM)	100	250	150	200	250	250	200	200	200
Intake Depth (NGVD)	-8	-9	-3.5	-3.4	-3.5	-3.5	---	---	---
Year Drilled	1964	1989	1967	1971	1982	1982	---	---	---

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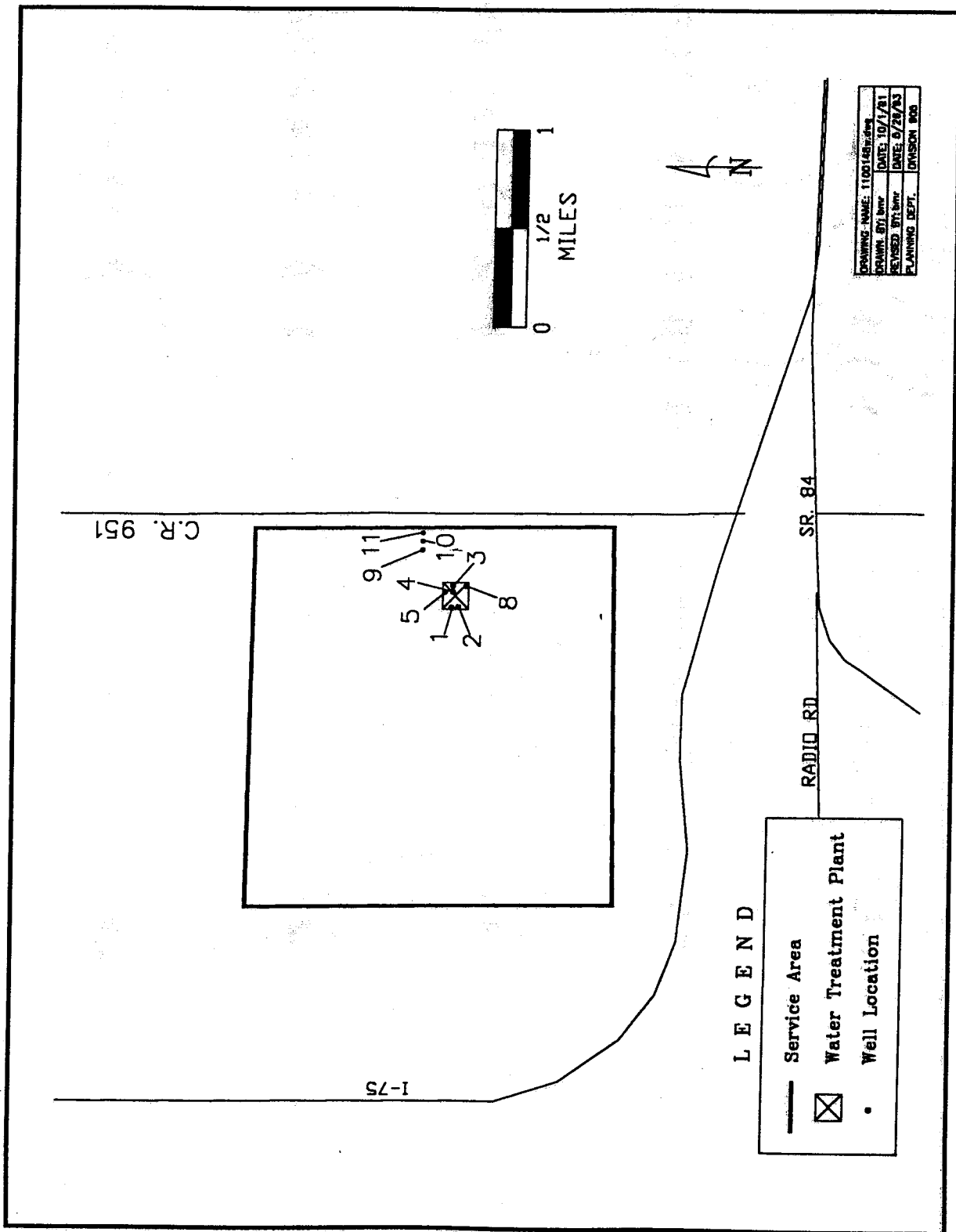


FIGURE E-4. Florida Cities Golden Gate Potable Water Supply Wells.

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Immokalee Water & Sewer District

SFWMD Permit Number: 11-00013-W
FDER PWS ID: 5110142

Raw Water Supply:

Raw water is withdrawn from 13 wells located in the Immokalee Water & Sewer District boundary. Four of the wells withdraw water from the sandstone aquifer while nine withdraw water from the lower Tamiami aquifer. The sandstone wells are 4 and 8 inches in diameter, have total depths between 275 and 315 feet, cased depths between 230 and 250 feet and were drilled between 1966 and 1973. Withdrawal capacities are between 100 and 390 GPM. The lower Tamiami wells are 6 and 8 inches in diameter, have total depths between 175 and 225 feet, cased depths between 90 and 154 feet and were drilled between 1977 and 1992. Withdrawal capacities are between 220 and 340 GPM. Specific well information is located in Table E-5 and the location of the wells can be found in Figure E-5.

The current SFWMD permit was issued January 17, 1991 and expires January 17, 2000. The approved allocations are:

Annual Allocation:	1.14 BGY (3.13 MGD)*
Maximum Daily Allocation:	4.50 MGD

*This allocation includes withdrawals from facilities identified in proposed section below

Treatment Method:

Immokalee has three aeration water treatment plants which have FDER rated capacity's as follows:

Main (9th Street) WTP	1.25 MGD
Carson Road WTP	0.75 MGD
Airport WTP	1.00 MGD

The water treatment plants have a cumulative capacity of 3.00 MGD. The location of these facilities are shown in Figure E-5. The system 1990 average daily flow was 2.50 MGD and the maximum day flow was 2.80 MGD.

Interconnections:

There are no interconnections with other potable water distribution systems.

Proposed:

The current consumptive use permit allows construction of 4 additional Lower Tamiami wells which are indicated in Table E-5 and Figure E-5.

Future:

Demand projections estimate a 2010 average daily flow of 3.15 MGD, with a maximum day flow of 4.42 MGD.

Source:

Information was obtained from the Immokalee Water-Sewer District and their engineers, and SFWMD water use permit files.

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TABLE E-5. Immokalee Potable Water Supply Wells.

Well Number	Main (9th Street) Water Treatment Plant										
	1	7	8	9	10A	11	12	13			
Planar Coordinates	360094 E 754878 N	759634 E 754561 N	360231 E 755285 N	359944 E 754642 N	360016 E 754319 N	360216 E 754630 N	361131 E 755786 N	361445 E 756615 N			
Status	Active	Active	Active	Active	Active	Active	Proposed	Proposed			
Aquifer	Sandstone	Lower Tamiame	Sandstone	Sandstone	Lower Tamiame	Sandstone	Lower Tamiame	Lower Tamiame			
Total Depth (ft)	275	225	315	275	175	278	200	200			
Cased Depth (ft)	236	140	230	250	95	234	140	140			
Well Diameter (in)	4	6	8	8	8	8	8	8			
Pump Capacity (GPM)	110	300	300	240	300	390	--	--			
Intake Depth (NGVD)	-237	-84	-231	-251	-96	-235	-141	-141			
Year Drilled	1966	1985	1970	1971	1987	1973	--	--			

TABLE E-5. (Continued).

Well Number	Carson Road Water Treatment Plant							Airport Water Treatment Plant			
	101	102	103	104	105	201	202	203	204		
Planar Coordinates	352425 E 763614 N	352286 E 763870 N	352955 E 764177 N	352408 E 761216 N	352490 E 760179 N	365944 E 760365 N	366295 E 760377 N	362406 E 760379 N	361277 E 760333 N		
Status	Active	Standby	Active	Active	Proposed	Active	Active	Active	Proposed		
Aquifer	Lower Tamiame	Lower Tamiame	Lower Tamiame	Lower Tamiame	Lower Tamiame	Lower Tamiame	Lower Tamiame	Lower Tamiame	Lower Tamiame		
Total Depth (ft)	200	--	210	210	200	187	187	155	200		
Cased Depth (ft)	125	154	140	140	140	107	108	115	140		
Well Diameter (in)	8	6	8	8	8	8	8	8	8		
Pump Capacity (GPM)	240	340	220	300	--	320	320	300	--		
Intake Depth (NGVD)	-126	-155	-141	-140	-141	-101	-101	-120	-141		
Year Drilled	1977	1984	1986	1992	--	1986	1986	1992	--		

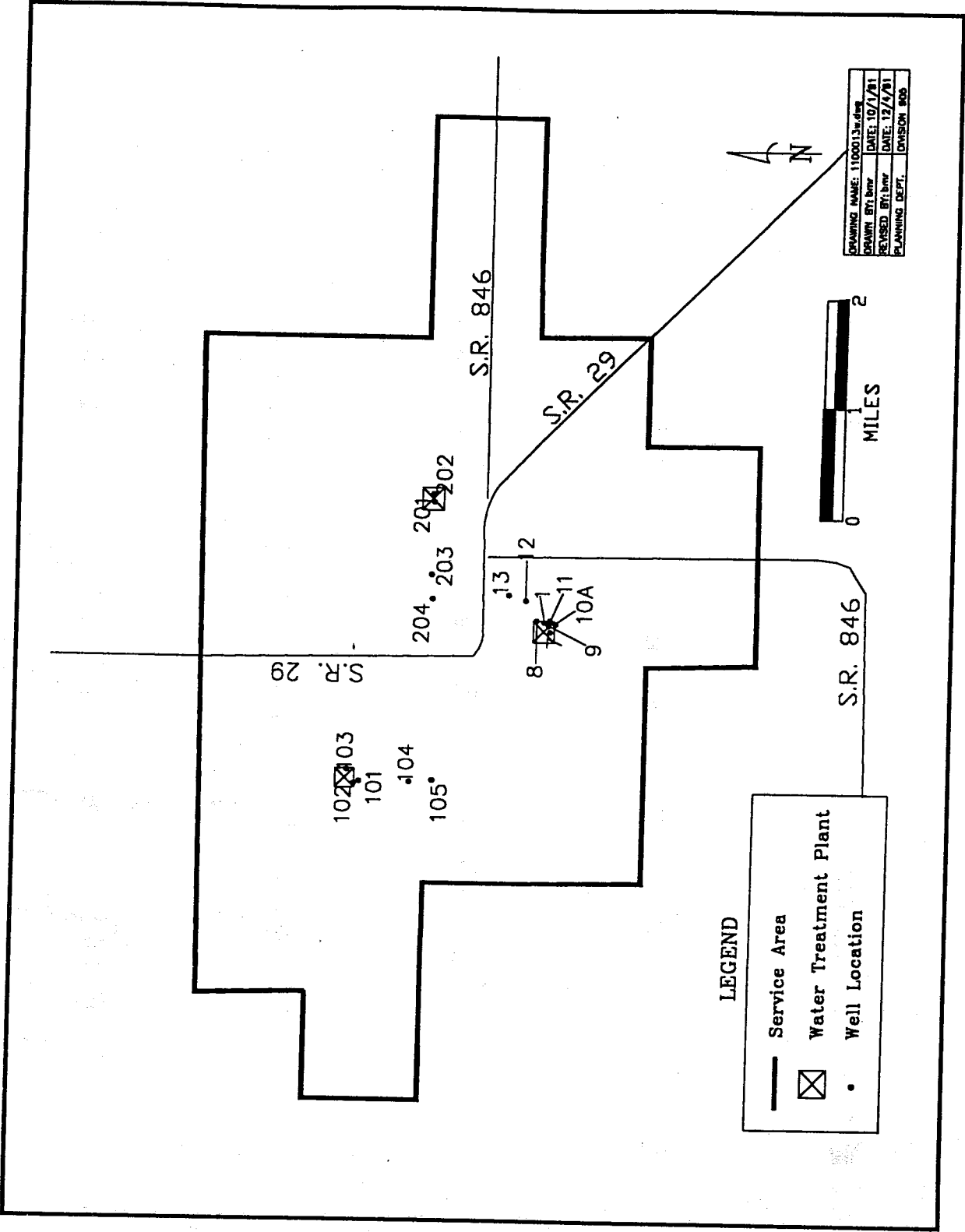


FIGURE E-5. Immokalee Potable Water Supply Wells.

Lower West Coast Water Supply Plan -- Appendix E

Marco Island Utilities

SFWMD Permit Number: 11-00080-W

FDER PWS ID: 5110183

Raw Water Supply:

Raw water is withdrawn from sources of water located on the mainland called the Marco Island Lakes and infiltration gallery and from the lower Hawthorn aquifer via wells located on Marco Island. The Marco Island Lakes water supply consists of two lakes with areas of 27 and 19 acres. Water is withdrawn from the lakes and blended with water from the infiltration gallery prior to pumping it approximately 11 miles to the water treatment plant located on Marco Island. The infiltration galleries consist of a 4,000 and a 3,000 foot long gallery. Marco Shores utility withdraws water from the 11 mile raw water transmission system to supply their treatment facility. The lower Hawthorn wellfield consists of ten 10-inch diameter wells which were drilled between 1989 and 1992. The wells have total depths between 540 and 596 feet and cased depths between 378 and 415 feet. The withdrawal capacity of each well is 550 GPM. Specific well information is located in Table E-6 and the location of the Marco Island Lakes infiltration gallery lower Hawthorn wells can be found in Figure E-6. In addition, Marco Island has an agreement to purchase 1 MGD of treated water from Collier County Utilities to blend with their raw water, if necessary.

The current SFWMD permit was issued May 13, 1993 and expires January 17, 1996. The approved allocations are:

Annual Allocation:

All Sources*	2.56 BGY (7.00 MGD)
Marco Island Lakes	1.93 BGY (5.30 MGD)
Infiltration Gallery	0.55 BGY (1.50 MGD)
Lower Hawthorn	1.97 BGY (5.40 MGD)

Maximum Daily Allocation

All Sources*	10.78 MGD
Marco Island Lakes	5.30 MGD
Infiltration Gallery	1.50 MGD
Lower Hawthorn Wells	5.40 MGD

* This includes sources listed in the proposed section below.

The 1990 average daily withdrawal was 5.12 MGD with a maximum day withdrawal of 7.61 MGD. Modeling by the utilities consultants indicates that a safe yield of 6.80 MGD from the lakes and infiltration galleries during critical dry periods could be realized.

The service area of this utility is in the Collier County reduced threshold area.

Treatment Method:

Treatment consists of an 8 MGD (FDER rated capacity) lime softening plant and a 4 MGD (FDER rated capacity) recently constructed reverse osmosis (RO) plant. These facilities are located on Marco Island (Figure E-6). The RO plant has a 75 percent efficiency and brine disposal and is by deep well injection in the boulder zone. The 1990 average daily water demand was 5.45 MGD and the maximum day water demand was 7.49 MGD.

Lower West Coast Water Supply Plan -- Appendix E

Interconnections:

There are no interconnections with other potable water distribution systems.

Proposed:

The current permit approves withdrawal from a rock pit known as the "Dude" pit. The Dude pit is an existing rock mining pit located on the mainland from which water will be withdrawn and pumped to the existing mainland facilities for blending and pumping to the water treatment plant.

The SFWMD approved allocations for the Dude Pit are:

Annual Allocation:	1.46 BGY (4 MGD)
Maximum Daily Allocation	4.00 MGD

The lease for the Marco Island Lakes expires the end of 1994. It appears this lease will not be renewed. Marco Island has approached the City of Naples on the availability of additional water from the City's East Golden Gate wellfield. A study is being conducted to indicate if an additional 7 MGD of water could be withdrawn from the wellfield, which would be needed by 1995.

Future:

The 1991 master plan indicates the ultimate potable demand of Marco Island is 16 MGD, and Marco Shores will ultimately use approximately 3 MGD, for a total demand of 19 MGD. The projected finished water demand for the year 2000 is 10.65 MGD for Marco Island and 0.79 MGD for Marco Shores. To meet this demand, additional raw water is proposed to be obtained from the "160 acre" site on the mainland and additional lower Hawthorn wells on the island. The 160 acre site, shown in Figure E-6, should be implemented by 1996. The additional wells will also be provided by 1996.

Treatment will be provided by expansions of the existing facilities. A portion of the existing lime softening plant will be modified/demolished to allow expansion of the wastewater treatment facility and a new 5 MGD lime softening facility will be constructed. The 5 MGD expansion is to be completed by 1996 for a total and ultimate lime softening capacity of 10 MGD. The RO facility will be expanded to its ultimate capacity of 6 MGD by year 2000.

Source:

Information was obtained from SSU Services (Marco Island Utilities) and SFWMD water use permit files.

Lower West Coast Water Supply Plan -- Appendix E

TABLE E-6. Marco Island Potable Water Supply Wells.

Well Number	1	2	3	4	5	6	7	8	9	10	11	12	13
Planar Coordinates	265394 E 579148 N	265629 E 578733 N	265777 E 578991 N	265936 E 578742 N	265493 E 580408 N	265921 E 583022 N	264076 E 583991 N	264263 E 585988 N	266795 E 585201 N	267392 E 584194 N	267464 E 586312 N	270425 E 582078 N	266283 E 583037 N
Status	Existing	Existing	Existing	Existing	Existing	Existing	Existing	Existing	Existing	Existing	Future	Future	Future
Aquifer	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn
Total Depth (ft)	565	574	548	547	540	596	573	574	546	580	600	600	600
Cased Depth (ft)	380	395	390	392	388	413	413	378	405	423	380	380	380
Well Diameter (in)	10	10	10	10	10	10	10	10	10	10	10	10	10
Pump Capacity (GPM)	550	550	500	550	550	550	550	550	550	550	500	500	500
Intake Depth (NGVD)	-110	-110	-110	-110	-120	-100	-100	-100	-100	-100	-100	-100	-100
Year Drilled	1991	1989	1989	1991	1991	1991	1991	1992	1992	1992	--	--	--

Lower West Coast Water Supply Plan -- Appendix E

Marco Shores

SFWMD Permit Number: 11-00080-W
FDER PWS ID: 5110182

Raw Water Supply:

Raw water is withdrawn from the 11 mile Marco Island raw water supply transmission main which is in the vicinity of Marco Shores. Raw water and permit information is discussed in the Marco Island utility description.

The 1990 average daily raw water demand was 0.11 MGD with a maximum day raw demand of 0.24 MGD.

The service area for this utility is in the Collier County reduced threshold area.

Treatment Method:

Treatment consists of a 0.72 MGD (FDER rated capacity) lime softening plant. This facility is located in Marco Shores (Figure E-6). The 1990 average daily demand was 0.13 MGD with a maximum day demand of 0.24 MGD.

Interconnections:

There are no interconnections with other potable water distribution systems.

Proposed:

See Marco Island.

Future:

The 1991 Marco Island master plan indicates the ultimate potable demand for Marco Shores will be 3 MGD. The year 2000 projected finished water demand is 0.79 MGD for Marco Shores.

Source:

Information was obtained from SSU Services (Marco Island Utilities) and SFWMD water use permit files.

Lower West Coast Water Supply Plan -- Appendix E

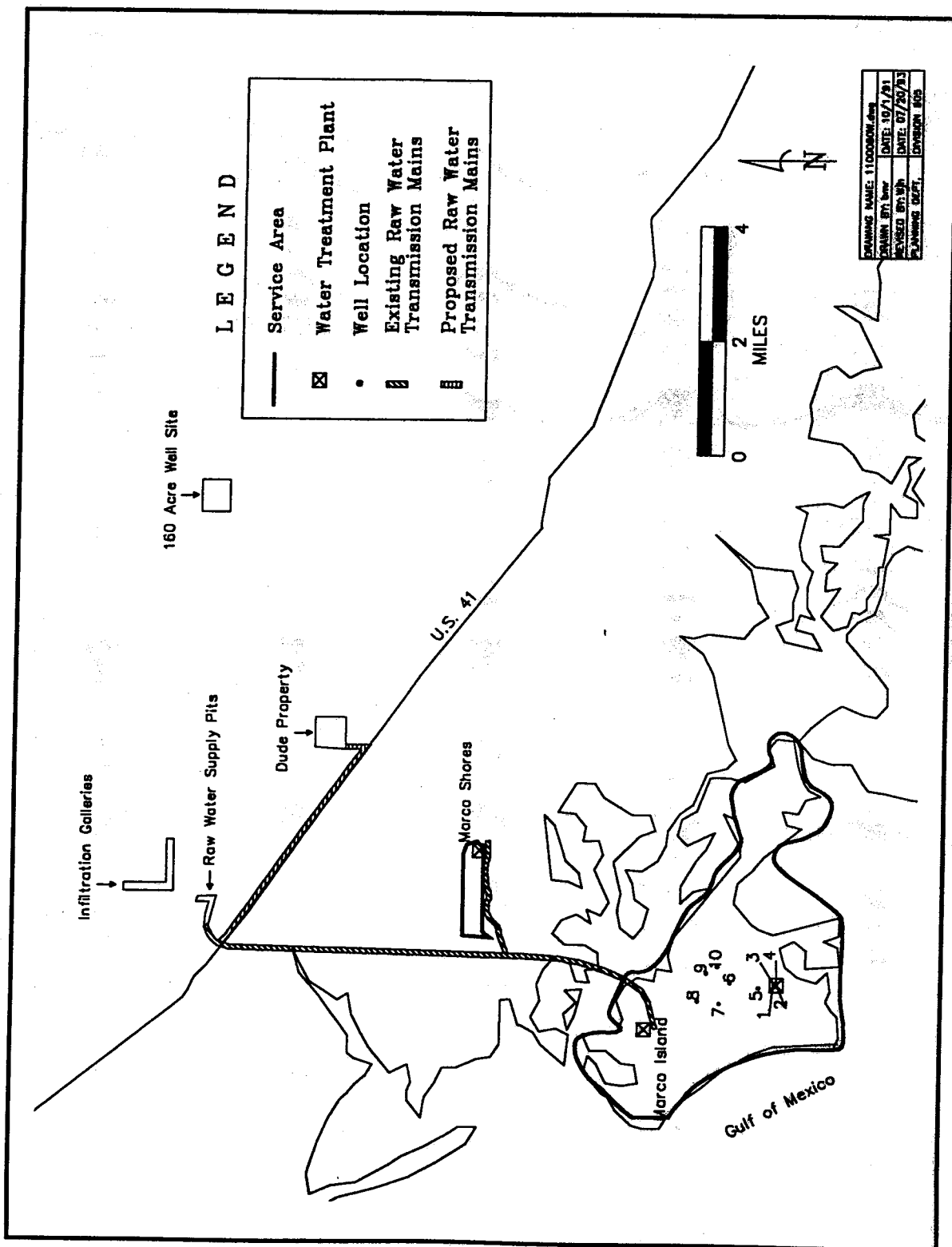


FIGURE E-6. Marco Island and Marco Shores Utilities Potable Water Supply Sources.

Lower West Coast Water Supply Plan -- Appendix E

Naples

SFWMD Permit Number: 11-00017-W
FDER PWS ID: 5110198

Raw Water Supply:

Raw water is withdrawn from two wellfields known as the Coastal Ridge and East Golden Gate wellfields. The Coastal Ridge wellfield consists of 42 wells with diameters of 8 and 16 inches withdrawing from the lower Tamiami aquifer. The wells have total depths between 40 and 96 feet, cased depths between 24 and 85 feet, and were drilled between 1953 and 1975. Each well has a withdrawal capacity of 350 GPM.

The East Golden Gate wellfield consists of twenty-four 14-inch diameter wells withdrawing from the lower Tamiami aquifer. The wells have total depths between 70 and 137 feet, cased depths between 37 and 51 feet and were drilled between 1978 and 1987. Withdrawal capacities are between 600 and 1000 GPM.

Specific well information is located in Table E-7 for the Coastal Ridge wellfield and Table E-8 for the East Golden Gate wellfield. The location of the wells can be found in Figure E-7.

The current SFWMD permit was issued April 13, 1989 and expires February 9, 1994. The approved allocations are:

Annual Allocation	6.01 BGY (16.46 MGD)
Maximum Daily Allocation	
Combined-Both Wellfields	22.55 MGD
Coastal Ridge Wellfield	11.60 MGD
East Golden Gate Wellfield	22.55 MGD

The 1990 average daily withdrawal from the Coastal Ridge and East Golden Gate wellfields were 2.55 MGD and 14.80 MGD, respectively.

The service area is in the Collier County reduced threshold area.

Treatment Method:

Treatment consists of a 30 MGD (FDER rated capacity) lime softening plant. This facility is located at 1000 Fleischmann Boulevard, Naples (Figure E-7). The 1990 average daily flow was 17.35 MGD, with a 1988 maximum day flow of 24.70 MGD.

Interconnections:

The distribution system has interconnects with Collier County Utilities at Pelican Bay, at the intersection of County Road 951 and Airport Road (12 inch), and at a location off Rattlesnake Road in East Naples (12 inch).

Proposed:

A water system master plan is being developed. In addition, a study of the East Golden Gate Wellfield is being conducted to investigate the possibility of supplying raw water to Florida Cities Golden Gate (0.20 MGD) and to Southern States Utilities-Marco Island (3 MGD initially; 6.2 MGD in 1996).

Lower West Coast Water Supply Plan -- Appendix E

Future:

The existing facilities are assumed to be sufficient to provide water to the city at build-out. The developments of Pelican Bay, Sutherland Center, Wyndemere, and Pine Ridge Industrial Park, which were previously served by the City of Naples, are now served by Collier County Utilities.

Source:

Information was obtained from the City of Naples Utilities Department and SFWMD water use permit files.

TABLE E-7. Naples Coastal Ridge Potable Water Supply Wells.

Well Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Planar Coordinates	240214 E 669124 N	240486 E 670084 N	241052 E 670119 N	240450 E 670876 N	240452 E 672048 N	240421 E 673246 N	240438 E 674130 N	240414 E 675227 N	240373 E 676451 N	240378 E 677712 N	240384 E 678802 N	240319 E 679643 N	240365 E 680279 N	240356 E 680986 N
Status	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Aquifer	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni
Total Depth (ft)	90	87	89	82	82	82	89	80	40	87	87	83	83	83
Cased Depth (ft)	56	57	56	53	54	51	60	58	24	54	64	64	63	64
Well Diameter (in)	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Pump Capacity (GPM)	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Intake Depth (NGVD)	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44
Year Drilled	1958	1958	1958	1962	1962	1962	1964	1964	1964	1964	1965	1965	1965	1965

TABLE E-7. (Continued).

Well Number	15	16	17	18	19	20	21	22	23	24	25	26	27
Planar Coordinates	240331 E 681654 N	240421 E 682957 N	240317 E 683628 N	240441 E 684587 N	240558 E 685563 N	240688 E 686759 N	240802 E 687777 N	240997 E 688986 N	241179 E 690454 N	241273 E 691515 N	241410 E 692494 N	241573 E 693582 N	241678 E 695331 N
Status	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Aquifer	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni	Lower Tamiarni
Total Depth (ft)	83	80	85	85	85	85	85	85	85	85	85	85	85
Cased Depth (ft)	64	--	61	61	61	62	61	61	61	63	62	62	61
Well Diameter (in)	8	16	8	8	8	8	8	8	8	8	8	8	8
Pump Capacity (GPM)	350	350	350	350	350	350	350	350	350	350	350	350	350
Intake Depth (NGVD)	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44
Year Drilled	1965	1968	1969	1969	1969	1969	1969	1969	1971	1971	1971	1971	1971

Lower West Coast Water Supply Plan -- Appendix E

TABLE E-7. (Continued).

Well Number	28	29	30	31	32	33	34	1A	2A	3A	4A	5A	6A	7A	8A
Planar Coordinates	326560 E 693901 N	241890 E 684184 N	242086 E 685065 N	241785 E 683217 N	243029 E 683196 N	244283 E 683181 N	245174 E 683233 N	238742 E 666811 N	239027 E 666456 N	238253 E 666444 N	239774 E 667327 N	238628 E 665861 N	239623 E 666175 N	237738 E 666163 N	237747 E 665513 N
Status	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Aquifer	Lower Tamilami	Lower Tamilami	Lower Tamilami	Lower Tamilami	Lower Tamilami	Lower Tamilami	Lower Tamilami	Lower Tamilami	Lower Tamilami	Lower Tamilami	Lower Tamilami	Lower Tamilami	Lower Tamilami	Lower Tamilami	Lower Tamilami
Total Depth (ft)	85	85	--	--	--	--	--	96	85	76	73	--	95	85	86
Cased Depth (ft)	61	61	--	--	--	--	--	85	58	55	50	--	74	70	68
Well Diameter (in)	8	8	8	8	8	8	8	6	8	--	6	6	10	10	10
Pump Capacity (GPM)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Intake Depth (NGVD)	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44
Year Drilled	1971	1971	1975	1975	1975	1975	1975	1953	1953	1953	--	1956	1968	1968	1968

Lower West Coast Water Supply Plan -- Appendix E

TABLE E-8. Naples East Golden Gate Potable Water Supply Wells.

Well Number	1	2	3	4	5	6	7	8	9	10	11	12
Planar Coordinates	326434 E 695331 N	326560 E 693901 N	326456 E 692573 N	326456 E 691246 N	326486 E 689952 N	326466 E 688600 N	326509 E 687298 N	326502 E 685936 N	326480 E 684639 N	326489 E 683296 N	326546 E 681992 N	326549 E 680655 N
Status	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Aquifer	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami
Total Depth (ft)	71	93	80	81	98	101	109	133	82	131	112	100
Cased Depth (ft)	42	48	39	42	42	42	47	42	42	42	37	37
Well Diameter (in)	14	14	14	14	14	14	14	14	14	14	14	14
Pump Capacity (GPM)	500	500	500	700	900	700	900	900	700	700	600	700
Intake Depth (NGVD)	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44
Year Drilled	1978	1978	1978	1978	1978	1978	1978	1978	1978	1978	1981	1981

TABLE E-8. (Continued).

Well Number	13	14	15	16	17	18	19	20	21	22	23	24
Planar Coordinates	326575 E 679305 N	326581 E 677959 N	326581 E 676639 N	326478 E 697851 N	326460 E 699130 N	362437 E 700467 N	326519 E 701486 N	326489 E 703096 N	326410 E 704185 N	321159 E 689867 N	321608 E 691208 N	321221 E 692561 N
Status	Active	Active	Standby	Active	Active	Active	Active	Active	Active	Active	Active	Active
Aquifer	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami
Total Depth (ft)	100	80	70	137	117	100	85	86	78	100	100	100
Cased Depth (ft)	40	38	38	39	40	39	42	46	51	40	40	40
Well Diameter (in)	14	14	14	14	14	14	14	14	14	14	14	14
Pump Capacity (GPM)	700	700	---	1000	1000	1000	1000	1000	600	700	700	700
Intake Depth (NGVD)	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44
Year Drilled	1981	1981	1981	1981	1981	1981	1985	1985	1985	1987	1987	1987

Lower West Coast Water Supply Plan -- Appendix E

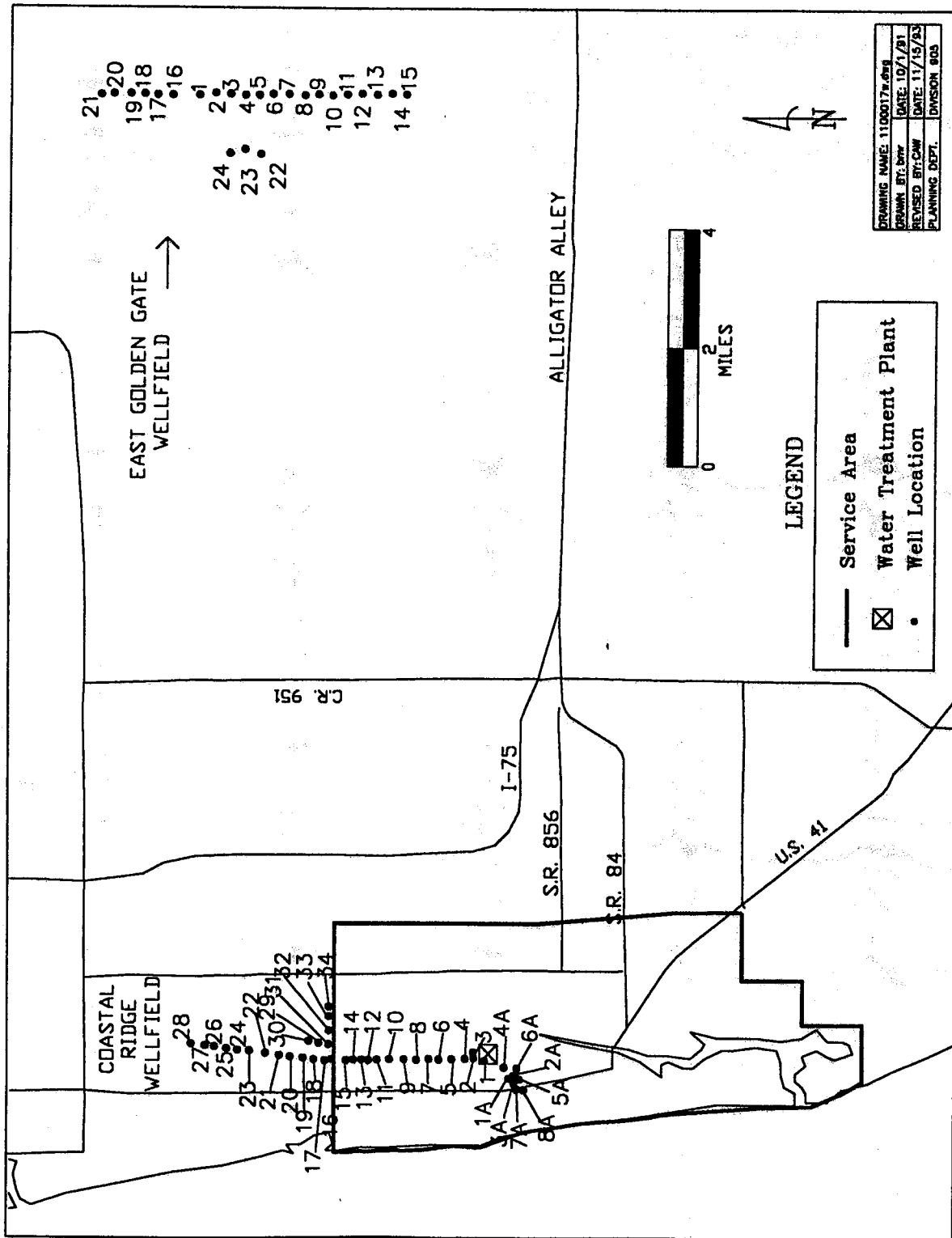


FIGURE E-7. Naples Coastal Ridge and East Golden Gate Potable Water Supply Wells.

Lower West Coast Water Supply Plan -- Appendix E

North Naples Utilities

SFWMD Permit Number: 11-00193-W
FDER PWS ID: 5114059

Raw Water Supply:

This system was purchased by Collier County Utilities and removed from service in the summer of 1993. Raw water was withdrawn from two 10-inch diameter wells located in the Quail Creek development. The wells withdrew water from the water table aquifer, had total depths of 35 and 40 feet, and cased depths of 20 and 18 feet, respectively. The wells were drilled in 1980 and 1981 and had withdrawal capacities of 300 GPM. Specific well information is given in Table E-9 and the previous location of the wells can be found in Figure E-8.

The current SFWMD permit was issued November 3, 1988 and expires November 3, 1993. The approved allocations are:

Annual Allocation:	345.20 MGY (0.95 MGD)
Maximum Daily Allocation:	1.30 MGD

The service area is located in the Collier County reduced threshold area.

Treatment Method:

Treatment was provided by a 0.75 MGD (FDER rated capacity) lime softening treatment facility. This facility was located southeast of the Quail Creek Country Club (Figure E-8). The 1990 average daily flow was 0.15 MGD, and the maximum day flow was 0.25 MGD. The water distribution system was connected to Collier County Utilities in the summer of 1993.

Interconnections:

There were no interconnections with other potable water distribution systems.

Proposed:

N/A

Future:

This facility was abandoned in the summer of 1993.

Source:

Information was obtained from North Naples Utilities, Inc. and SFWMD water use permit files.

Lower West Coast Water Supply Plan -- Appendix E

TABLE E-9. North Naples Potable Water Supply Wells.

Well Number	1	2
Planar Coordinates	263238 E 711348 N	263138 E 710925 N
Status	Deactivated	Deactivated
Aquifer	Water Table	Water Table
Total Depth (ft)	35	40
Cased Depth (ft)	20	18
Well Diameter (in)	10	10
Pump Capacity (GPM)	300	300
Intake Depth (NGVD)	-15	-13
Year Drilled	1980	1981

Lower West Coast Water Supply Plan -- Appendix E

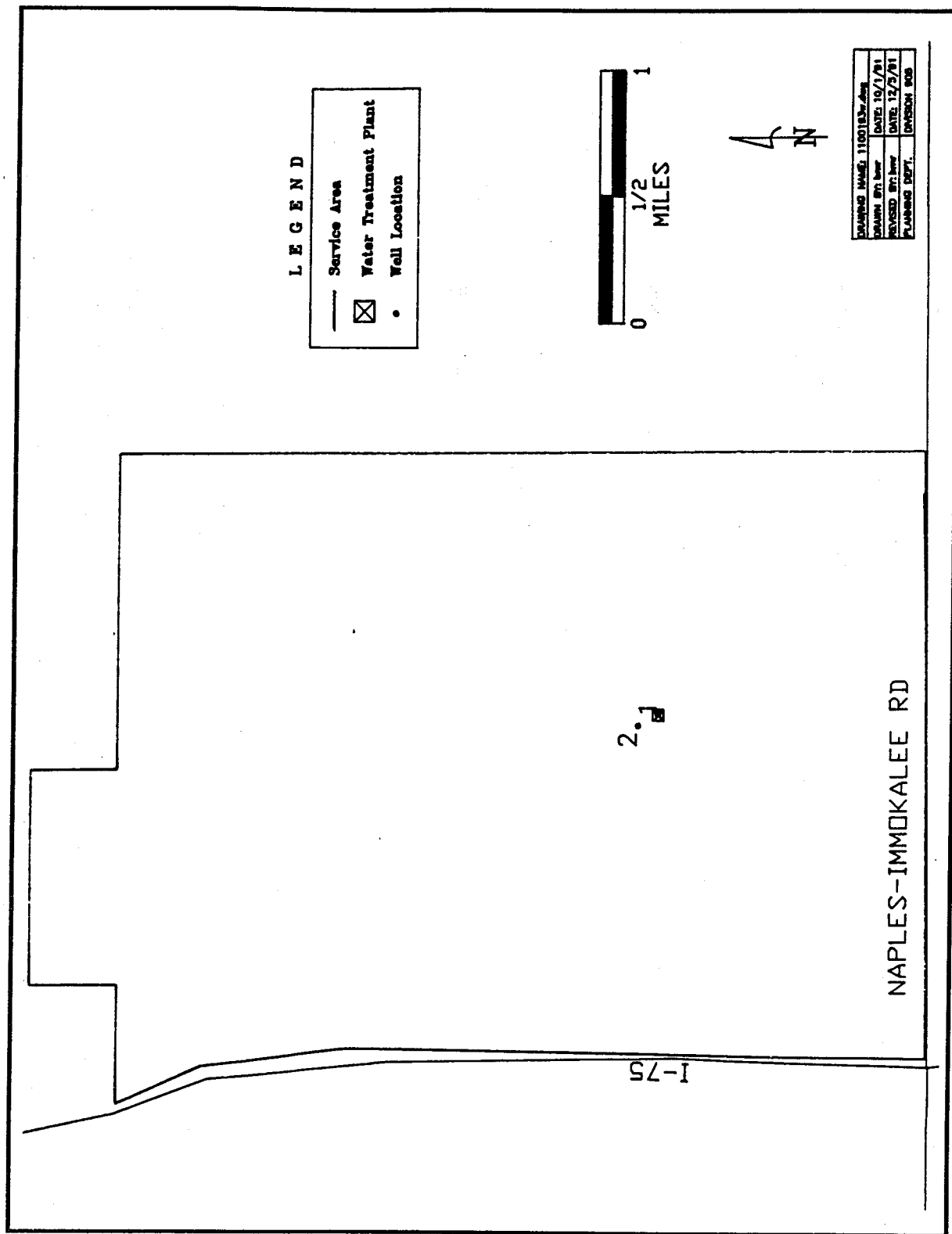


FIGURE E-8. North Naples Potable Water Supply Wells.

Lower West Coast Water Supply Plan -- Appendix E

Orangetree Utility Co.

SFWMD Permit Number: 11-00419-W
FDER PWS ID: 5114085

Raw Water Supply:

Raw water is withdrawn from two wells located north of Oilwell Road and east of Immokalee Road (County Road 846). The wells, which were drilled in 1987 and 1988, withdraw water from the lower Tamiami aquifer and are 12 inches in diameter. They have total depths of 100 feet and cased depths of 78 and 75 feet. The design pumping capacities are 500 gallons per minute. Specific well information is given in Table E-10 and the location of the wells are shown in Figure E-9.

The current SFWMD permit was issued September 10, 1987 and expires September 10, 1997. The approved allocations are:

Annual Allocation:	158.78 MGY (0.44 MGD)
Maximum Daily Allocation:	0.65 MGD

The service area is located in the Collier County reduced threshold area.

Treatment Method:

Treatment is provided by a 0.43 MGD (FDER rated capacity) lime softening facility. This facility is located north of Oilwell Road, one mile east of County Road 951 in Collier County (Figure E-9). The 1990 average daily flow was 0.006 MGD and the maximum day flow was 0.011 MGD.

Interconnections:

There are no distribution system interconnections with other utilities.

Proposed:

N/A

Future:

The estimated maximum project demand is 0.92 MGD and is anticipated to take place prior to 2010. It is anticipated that two additional wells (one production and one standby) will be constructed in the vicinity of the existing wells as demands increase. The anticipated future treatment method is lime softening. This system will eventually be absorbed into the Collier County Utility system.

Source:

Information was obtained from Wilson, Miller, Barton & Peek, Inc. for the Orangetree Utility Co., and SFWMD water use permit files.

Lower West Coast Water Supply Plan -- Appendix E

TABLE E-10. Orangetree Potable Water Supply Wells.

Well Number	1	2
Planar Coordinates	308907 E 712671 N	307954 E 713652 N
Status	Active	Standby
Aquifer	Lower Tamiami	Lower Tamiami
Total Depth (ft)	100	100
Cased Depth (ft)	78	75
Well Diameter (in)	12	12
Pump Capacity (GPM)	500	500
Intake Depth (ft)	--	--
Year Drilled	1987	1988

Lower West Coast Water Supply Plan -- Appendix E

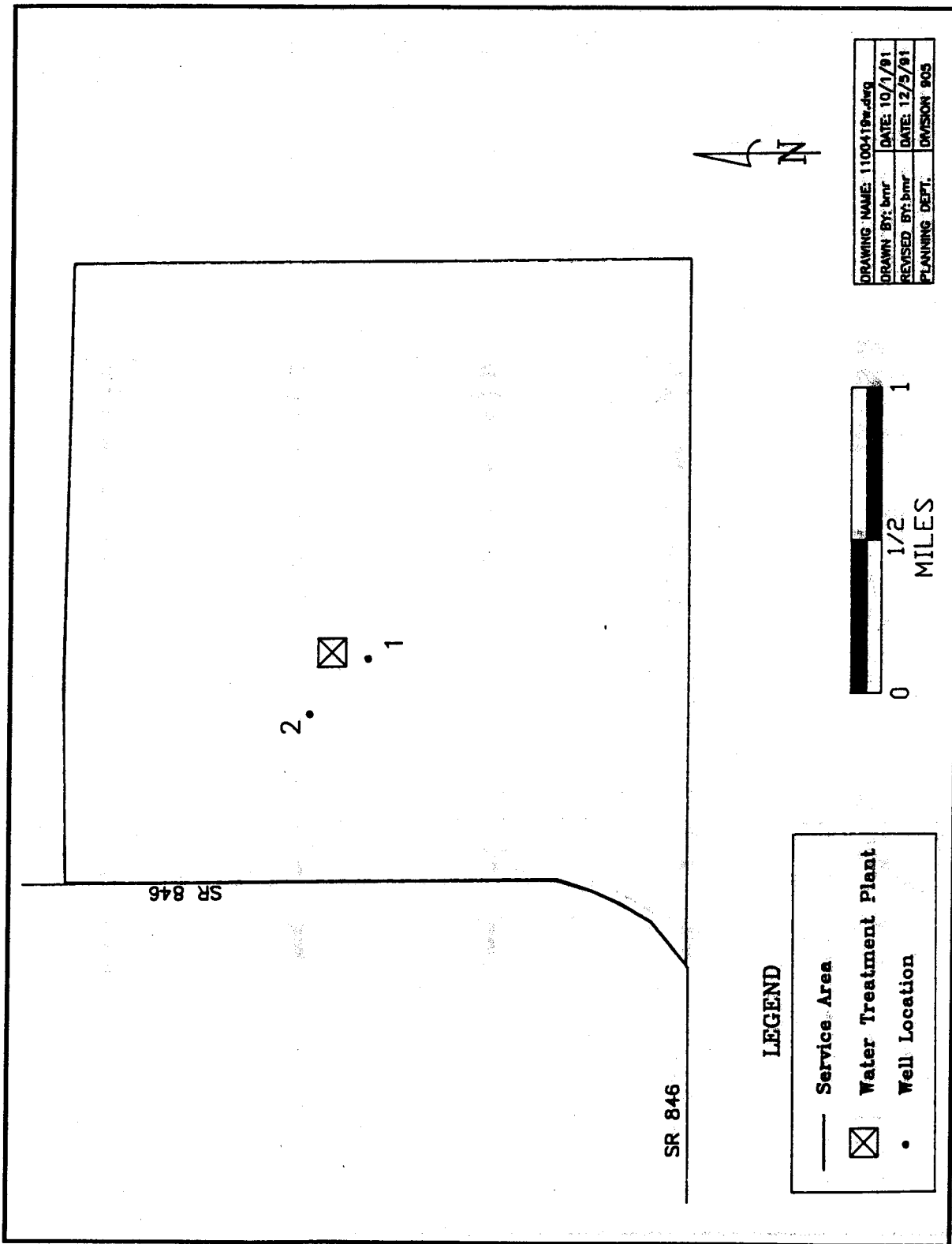


FIGURE E-9. Orangetree Utility Potable Water Supply Wells.

Lower West Coast Water Supply Plan -- Appendix E

Port of the Islands

SFWMD Permit Number: 11-00271-W
FDER PWS ID: 5110230

Raw Water Supply:

Raw water is withdrawn from two wells located northeast of the Port of the Islands development in Section 2, Range 52S, Township 28E. The wells withdraw water from the mid-Hawthorn aquifer, have total depths of 380 feet, and cased depths of 300 feet. The wells were drilled in 1966. The pumping capacities are approximately 300 GPM. Specific well information is provided in Table E-11 and the location of the wells can be found in Figure E-10.

The current SFWMD permit was issued October 11, 1984 and expires October 11, 1994. The approved allocations are:

Annual Allocation:	105.00 MGY (0.29 MGD)
Maximum Daily Allocation:	0.43 MGD

The service area is located in the Collier County reduced threshold area.

Treatment Method:

Treatment is provided by a 0.39 MGD aeration facility. The facility is located north of U.S. 41 in the Port of the Islands development (Figure E-10). The 1990 average daily flow was 0.14 MGD and the maximum day flow was 0.22 MGD.

Interconnections:

There are no distribution interconnections with other utilities.

Proposed:

A 0.50 MGD lime softening water treatment facility will be constructed in late 1993.

Future:

The existing facility is anticipated to serve the area's build-out capacity. A facility expansion is not anticipated.

No additional construction/expansion of this facility is proposed. However, one additional well may be drilled in the same proximity of the existing wells at a later date.

Source:

Information was obtained from the Port of the Islands Community Improvement District and SFWMD water use permit files.

Lower West Coast Water Supply Plan -- Appendix E

TABLE E-11. Port of the Islands Potable Water Supply Wells.

Well Number	1	2
Planar Coordinates	341288 E 597909 N	342232 E 597959 N
Status	Active	Active
Aquifer	Mid-Hawthorn	Mid-Hawthorn
Total Depth (ft)	380	380
Cased Depth (ft)	300	300
Well Diameter (in)	6	6
Pump Capacity (GPM)	300	300
Intake Depth (NGVD)	-300	-300
Year Drilled	1966	1966

Note: Wells alternated every two weeks.

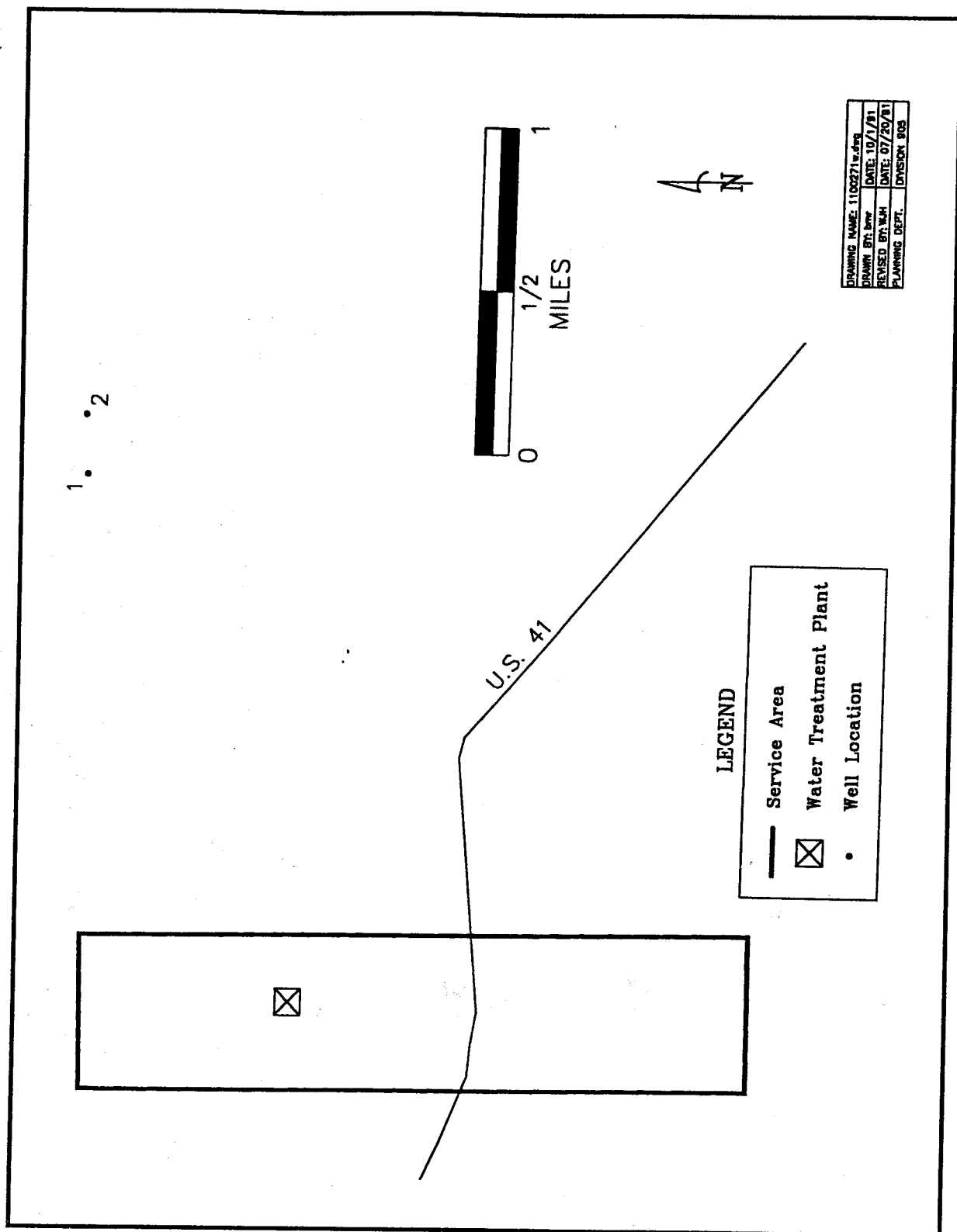


FIGURE E-10. Port of the Islands Potable Water Supply Wells.

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Lower West Coast Water Supply Plan -- Appendix E

HENDRY COUNTY

POTABLE WATER TREATMENT FACILITIES

Lower West Coast Water Supply Plan -- Appendix E

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Lower West Coast Water Supply Plan -- Appendix E

City of La Belle

SFWMD Permit Number: 26-00105-W
FDER PWS ID: 5260050

Raw Water Supply:

Raw water is withdrawn from seven wells located in and around the City of La Belle. The wells are incorporated into two wellfields known as the water treatment plant and the city wellfields. The wells, which were drilled between 1930 and 1989, withdraw water from the water table aquifer and are 6 and 12 inches in diameter. They have total depths between 24 and 32 feet and cased depths between 20 and 25 feet. The design pumping capacities are between 140 and 290 GPM. Specific well information is given in Table E-12 and the location of the wells can be found in Figure E-11.

The current SFWMD permit was issued January 8, 1989 and expires December 31, 1997. The approved allocations are:

Annual Allocation:	255.50 MGY (0.70 MGD)
Maximum Daily Allocation:	
Water Plant Wellfield	0.60 MGD
Both Wellfields	1.40 MGD

The 1990 average daily withdrawal was 0.56 MGD with a maximum day of 0.88 MGD.

The service area is located in the Hendry County reduced threshold area.

Treatment Method:

Treatment is provided by a 1.50 MGD (FDER rated capacity) lime softening treatment facility. This facility is located at the intersection of Main Street and Euclid Avenue, La Belle (Figure E-11). The 1990 average daily potable water demand was 0.53 MGD and the maximum day flow was 0.79 MGD.

Interconnections:

This facility has one 6-inch interconnection with Port La Belle Utilities at the intersection of Seminole Avenue (not existing) and Ford Road.

Proposed:

N/A

Future:

The city's comprehensive plan projected a year 2010 average water demand of 1.16 MGD based on a 125 GPD per capita.

Source:

Information was obtained from the City of La Belle consumptive use permit, the City of La Belle comprehensive plan, and SFWMD water use permit files.

TABLE E-12. La Belle Potable Water Supply Wells.

Well Number	1	2	3	4	5	6	7
Planar Coordinates	348623 E 874231 N	348603 E 873963 N	348609 E 873626 N	348610 E 873325 N	356274 E 881524 N	356293 E 881869 N	356692 E 881535 N
Status	Active	Active	Active	Active	Active	Active	Active
Aquifer	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Total Depth (ft)	26	26	26	26	24	32	30
Cased Depth (ft)	20	20	20	20	20	25	25
Well Diameter (in)	12	12	12	12	6	6	6
Pump Capacity (GPM)	290	140	290	290	250	250	250
Intake Depth (NGVD)	-15	-15	-15	-15	-18	-20	-20
Year Drilled	1978	1981	1978	1981	1930	1930	1989

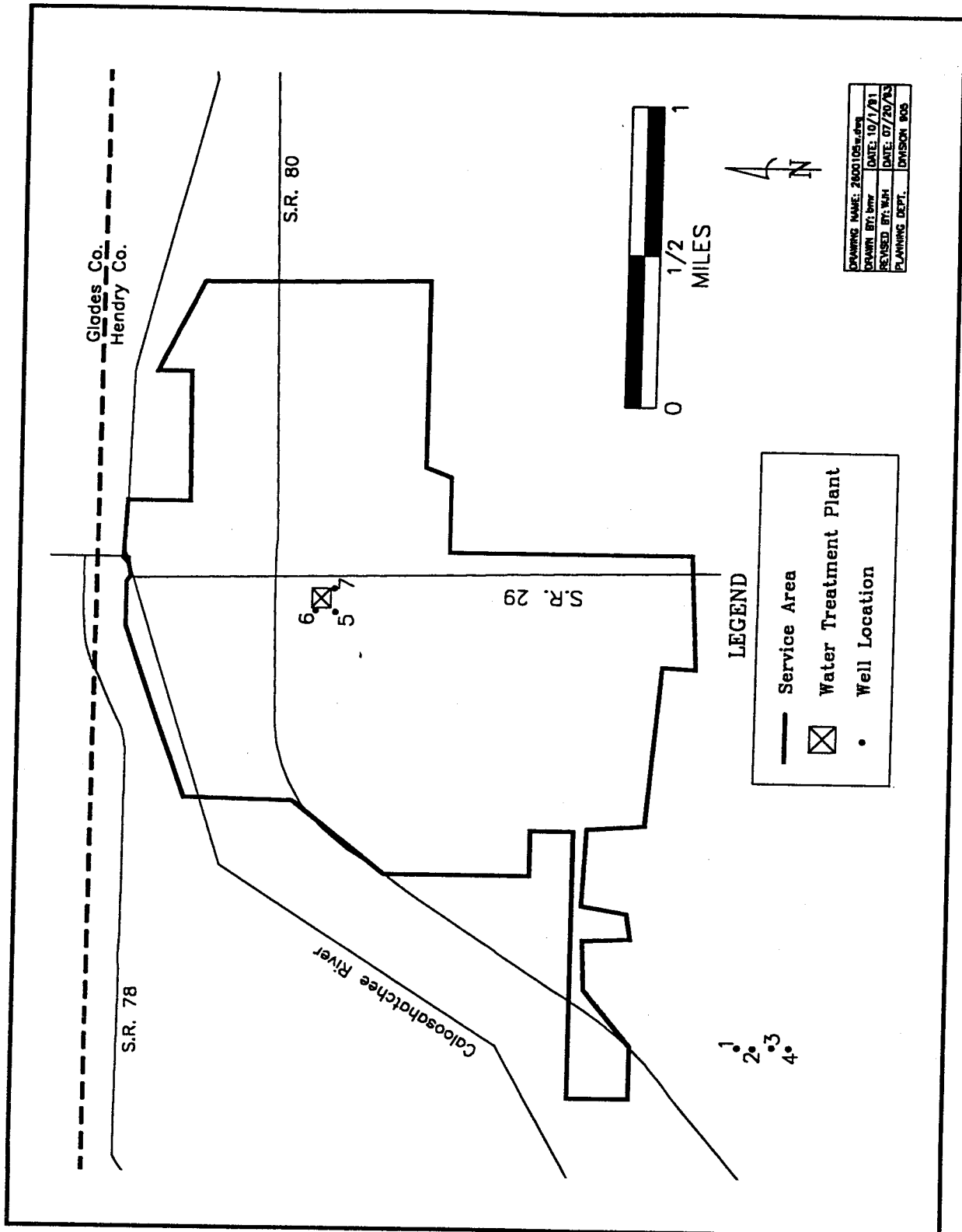


FIGURE E-11. City of La Belle Potable Water Supply Wells.

Lower West Coast Water Supply Plan -- Appendix E

Port La Belle Utilities

SFWMD Permit Number: 26-00096-W
FDER PWS ID: 5260226

Raw Water Supply:

Raw water is withdrawn from two wells located in the Port La Belle utility area. The wells, which were drilled in 1973 and 1983, withdraw water from the sandstone aquifer and are 8 and 14 inches in diameter. They have total depths of 300 and 283 feet, and cased depths of 250 and 220 feet, respectively. The withdrawal capacities are 450 and 500 GPM. Specific well information is provided in Table E-13 and the location of the wells can be found in Figure E-12.

The current SFWMD permit was issued May 12, 1988 and expires May 12, 1997. The approved allocations are:

Annual Allocation:	98.20 MGY (0.27 MGD)
Maximum Daily Allocation:	0.80 MGD

Treatment Method:

Treatment is provided by a 0.50 MGD (FDER rated capacity) lime softening treatment facility. This facility is located at Cedarwood Parkway and State Road 80, Port La Belle (Figure E-12). The 1990 average daily flow was 0.18 MGD and the maximum day flow was 0.26 MGD.

Interconnections:

This facility has one 6-inch interconnection with City of La Belle at the intersection of Seminole Avenue (not existing) and Ford Road.

Proposed:

The developers of Port La Belle are proposing to reduce the original size of the development by 22,000 acres, which will substantially reduce the number of dwelling units.

Future:

N/A

Source:

Information was obtained from General Development Utilities, Inc., and SFWMD water use permit files.

Lower West Coast Water Supply Plan -- Appendix E

TABLE E-13. Port La Belle Potable Water Supply Wells.

Well Number	1	2
Planar Coordinates	377250 E 883997 N	377250 E 884598 N
Status	Active	Active
Aquifer	Sandstone	Sandstone
Total Depth (ft)	300	283
Cased Depth (ft)	250	220
Well Diameter (in)	8	8
Pump Capacity (GPM)	450	500
Intake Depth (ft)	64	53
Year Drilled	1973	1983

Note: Wells alternated monthly.

Lower West Coast Water Supply Plan -- Appendix E

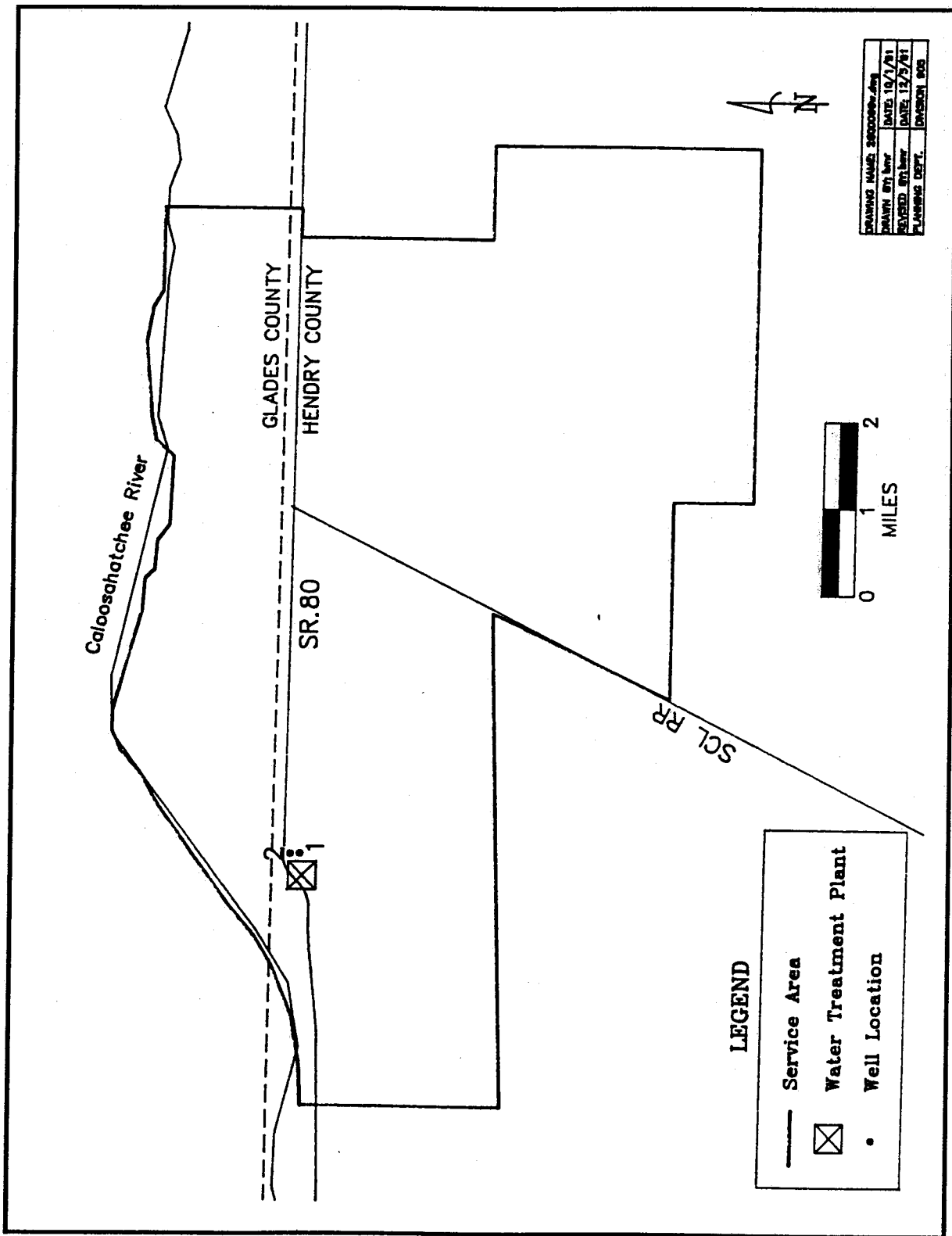


FIGURE E-12. Port La Belle Potable Water Supply Wells.

Lower West Coast Water Supply Plan -- Appendix E

U.S. Sugar Corporation

SFWMD Permit Number: 26-00024-W
FDER PWS ID: 5260297

Raw Water Supply:

Raw water is withdrawn from Lake Okeechobee via an intake structure located in the lake north of Clewiston.

The current SFWMD permit was issued December 12, 1985 and expires December 12, 1995. The approved allocations are:

Annual Allocation:	1.18 BGY (3.23 MGD)
Maximum Daily Allocation:	6.46 MGD

Treatment Method:

Treatment is provided by a 6 MGD (FDER rated capacity) lime softening treatment facility. This facility is located one mile south of downtown Clewiston (Figure E-13). The 1990 average daily flow was 2.85 MGD and the maximum day flow was 5.92 MGD. This facility serves the Sugar House, the City of Clewiston and the South Shore Water Association.

Interconnections:

There are no interconnections with other potable water distribution systems.

Proposed:

N/A

Future:

The 1989 facilities plan projects that the maximum day demand will increase to 5.21 MGD by year 2000 and 5.33 MGD by the 2010. An expansion of this facility is not anticipated unless regulations become more stringent and dictate a need to increase treatment.

Source:

Information was obtained from the United States Sugar Corporation and SFWMD water use permit files.

Lower West Coast Water Supply Plan -- Appendix E

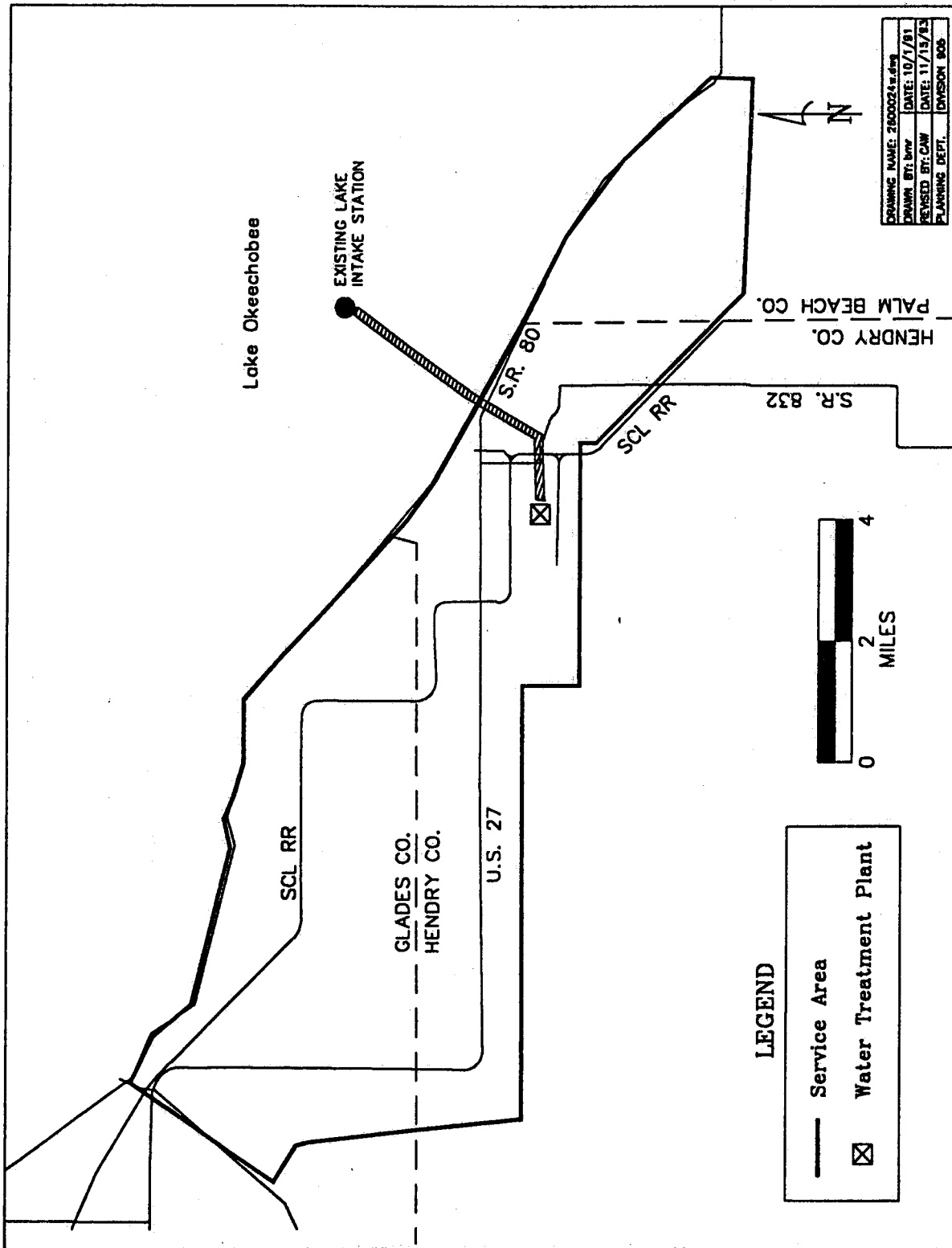


FIGURE E-13. U.S. Sugar Water Treatment Plant.

Lower West Coast Water Supply Plan -- Appendix E

LEE COUNTY

POTABLE WATER TREATMENT FACILITIES

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Lower West Coast Water Supply Plan -- Appendix E

Bonita Springs Utilities

SFWMD Permit Number: 36-00008-W
FDER PWS ID: 5360025

Raw Water Supply:

Raw water is supplied from the east and west wellfield. The west wellfield is operational while the east has been permitted but not yet constructed. It is described in the proposed section. The west wellfield consists of 16 wells located along the north-south line in sections 18, 19, 30, and 31 of Township 47S, Range 26E. The wells, which were drilled between 1971 and 1988, withdraw water from the lower Tamiami aquifer and are 8 and 12 inches in diameter. They have total depths between 80 and 115 feet and cased depths between 58 and 85 feet. The design pumping capacities are between 125 and 350 GPM. Specific well information is provided in Table E-14 and the location of the wells are identified in Figure E-14.

The current SFWMD permit was issued April 15, 1993 and expires April 15, 1998. The approved allocations are:

Annual Allocation:	1.22 BGY (3.35 MGD)
West Wellfield	0.98 BGY (2.69 MGD)
Maximum Daily Allocation:	4.73 MGD
West Wellfield:	3.18 MGD*

*Prior to completion of East Wellfield -- 3.81 MGD allowed until that time.

The service area is located in the Lee County reduced threshold area.

Treatment Method:

Treatment is provided by a 6.00 MGD (FDER rated capacity) lime softening treatment facility. This facility is located at 11860 East Terry Street, Bonita Springs (Figure E-14). The 1990 average daily flow was 2.15 MGD and the maximum day flow was 3.00 MGD.

Interconnections:

There are no interconnections with other potable water distribution systems.

Proposed:

The current consumptive use permit allows construction of eight additional supply wells in the proposed East Terry Street wellfield as indicated on Figure E-16. The wells will be operational by the middle of 1994. This wellfield will allow some operational flexibility by distributing ground water withdrawals between the existing and proposed wellfields during the dry and wet seasons and minimize saltwater intrusion. Specific well information on the proposed wells is located in Table E-14 and the location of the wells are identified in Figure E-14.

Future:

The projected water use by the utility for this system is anticipated to increase to 3.84 MGD on average by 2001. Two future expansions of 3 MGD each for a total facility capacity of 12 MGD can be accommodated at this site as demand dictates. The method of treatment will be lime softening.

Lower West Coast Water Supply Plan -- Appendix E

Source:

Information was obtained from the Bonita Springs Water System, Inc. and SFWMD water use permit files.

TABLE E-14. Bonita Springs Potable Water Supply Wells.

Well Number	1	2	3	4	5	6	7	8	9	10	11	12
Planar Coordinates	252928 E 735224 N	252837 E 734311 N	252843 E 733364 N	252887 E 732518 N	252929 E 731571 N	252970 E 730686 N	252944 E 736127 N	253064 E 737561 N	253088 E 738541 N	252925 E 739369 N	253003 E 729812 N	253192 E 740872 N
Status	Standby	Standby	Standby	Standby	Active	Active	Active	Active	Active	Active	Active	Active
Aquifer	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami
Total Depth (ft)	80	80	80	80	80	80	97	85	85	90	97	105
Cased Depth (ft)	64	65	65	64	64	58	66	70	70	66	67	72
Well Diameter (in)	8	8	8	8	8	8	12	8	8	12	12	12
Pump Capacity (GPM)	---	---	---	---	350	150	250	125	150	300	350	325
Intake Depth (NGVD)	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60
Year Drilled	1971	1971	1971	1971	1971	1971	1983	1979	1979	1983	1983	1988

TABLE E-14. (Continued).

Well Number	13	14	15	16	17	18	19	20	21	22	23	24
Planar Coordinates	253211 E 742037 N	252644 E 742940 N	252590 E 743963 N	252563 E 745032 N	263387 E 732215 N	263387 E 732617 N	263387 E 732986 N	263337 E 733456 N	263761 E 731827 N	263761 E 731346 N	263395 E 731046 N	263414 E 730578 N
Status	Active	Active	Active	Active	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed
Aquifer	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami	Lower Tamiami
Total Depth (ft)	110	115	115	115	100	100	100	100	100	100	100	100
Cased Depth (ft)	78	80	85	85	70	70	70	70	70	70	70	70
Well Diameter (in)	12	12	12	12	12	12	12	12	12	12	12	12
Pump Capacity (GPM)	325	325	325	325	700	700	700	700	700	700	700	700
Intake Depth (NGVD)	-60	-60	-60	-60	---	---	---	---	---	---	---	---
Year Drilled	1988	1988	1988	1988	---	---	---	---	---	---	---	---

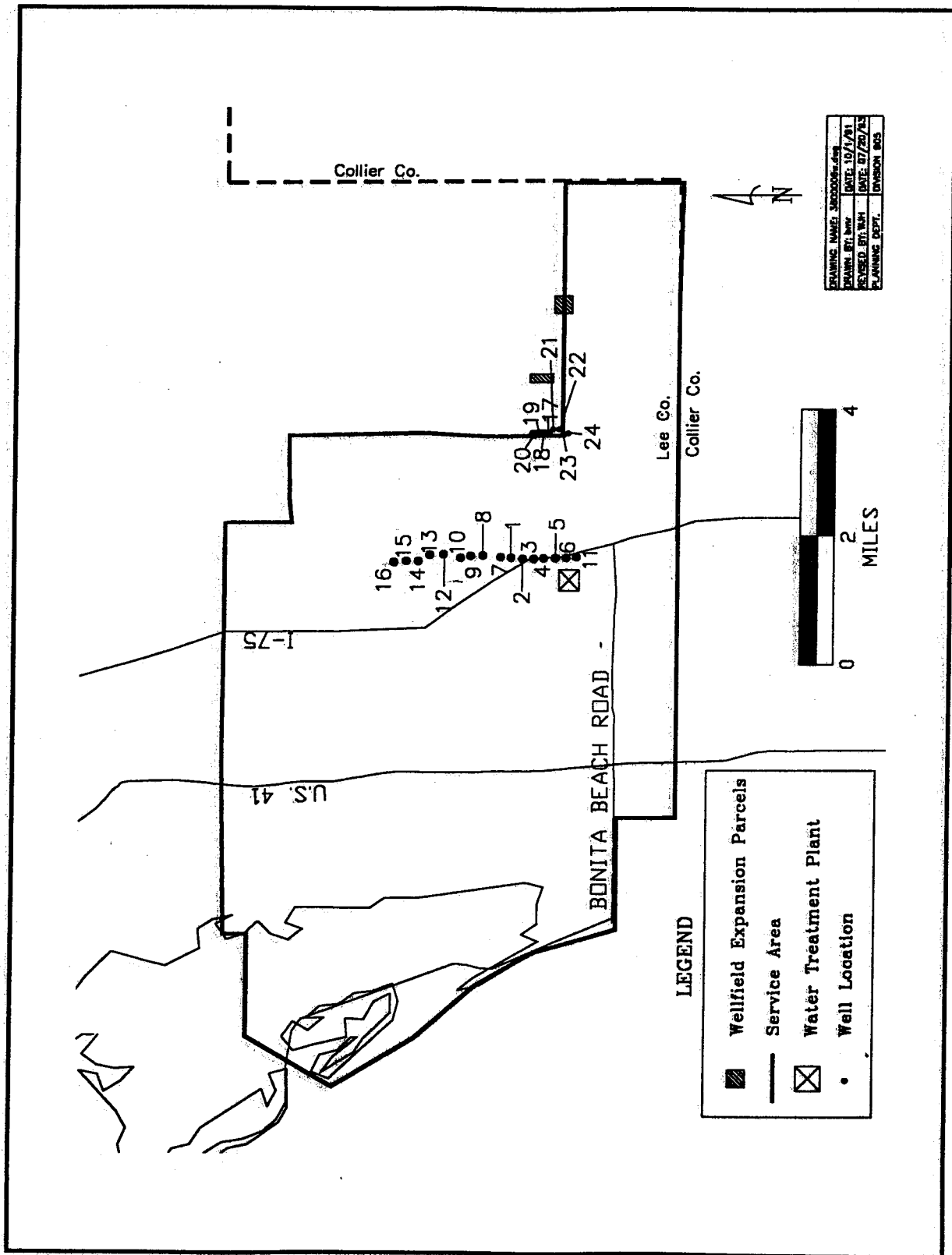


FIGURE E-14. Bonita Springs Potable Water Supply Wells.

Lower West Coast Water Supply Plan -- Appendix E

Cape Coral

SFWMD Permit Number: 36-00046-W
FDER PWS ID: 5360325

Raw Water Supply:

Raw water is withdrawn from the lower Hawthorn aquifer via 23 wells located in Cape Coral. The wells are 10 and 12 inches in diameter, have total depths between 642 and 900 feet, cased depths between 345 and 600 feet and were drilled between 1975 and 1990. Withdrawal capacities are between 200 and 850 GPM. Specific well information is given in Table E-15 and the location of the wells can be found in Figure E-15.

The current SFWMD permit was issued May 14, 1992 and expires May 14, 1997. The approved allocations are:

Annual Allocation	4.23 BGY (11.59 MGD)
Maximum Daily Allocation	14.25 MGD

The service area is in the Lee County reduced threshold area and is designated as an Area of Special Concern.

Treatment Method:

Treatment consists of a 14 MGD (FDER rated capacity) reverse osmosis water treatment facility. This facility is located at 3300 SW 20th Avenue, Cape Coral (Figure E-15). The RO plant has an efficiency of 85%, with brine reject disposal via a surface water discharge to a lake which is part of the Cape Coral tidal canal system. The 1990 average daily flow was 8.44 MGD, and this facility had a maximum day flow of 12.30 MGD in 1988.

Interconnections:

The water distribution system has one interconnect with Florida Cities Waterway Estates at Hancock Bridge Parkway and 24th Avenue (10 inches). In addition, an 8-inch interconnect will be available with the Pine Island Water Association in 1994.

Proposed:

An additional water supply well is anticipated to be drilled in 1993. This well is approved by the previously stated permit. The proposed well information is given in Table E-15 and the location of the well can be found in Figure E-15.

Future:

Utility flow projections for this facility estimate a 1993 average daily potable water demand of 9.75 MGD, and a maximum day demand of 11.70 MGD if water is available throughout the city based on population projections and per capita flow estimates. Additionally, the ultimate build-out (estimated to be in 40 years) potable water demand projection is 36 MGD average daily flow with a maximum day flow of 43 MGD. To meet this demand, it is planned to expand the existing facility to 22 MGD. Planned expansions have been postponed as the result of WICC (see Wastewater Cape Coral Everest), and construct a new north treatment facility at a future date which will have an ultimate capacity of 21 MGD. The treatment method will be RO. The new facility will be supplied by a new wellfield withdrawing from the lower Hawthorn and Suwannee aquifers located on Diplomat Parkway. A raw water withdrawal of 46.5 MGD is necessary to meet the projected 36 MGD demand. The

Lower West Coast Water Supply Plan -- Appendix E

location of the proposed water treatment facility and wellfield is indicated in Figure E-15.

Source:

Information was obtained from the City of Cape Coral-Utilities Department and SFWMD water use permit files.

TABLE E-15. Cape Coral Potable Water Supply Wells.

Well Number	1	2	3	4	5	6	7	8	9	10	11	12
Planar Coordinates	167540 E 821817 N	167456 E 821564 N	167498 E 821352 N	166314 E 821902 N	165680 E 821944 N	165004 E 821944 N	170668 E 820252 N	170669 E 817756 N	170627 E 815176 N	167244 E 818645 N	168541 E 833016 N	170246 E 832977 N
Status	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Aquifer	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn
Total Depth (ft)	745	685	705	700	765	900	752	752	748	748	762	742
Cased Depth (ft)	362	347	345	350	345	362	357	345	350	350	600	599
Well Diameter (in)	10	12	12	12	12	12	12	12	12	12	12	12
Pump Capacity (GPM)	540	600	850	500	500	200	425	490	470	500	550	560
Intake Depth (NGVD)	-70	-70	-70	-70	-70	-70	-95	-95	-95	-95	-80	-80
Year Drilled	1975	1975	1975	1975	1975	1975	1982	1982	1982	1982	1984	1984

TABLE E-15. (Continued).

Well Number	13	14	15	16	17	18	19	20	21	22	23	24
Planar Coordinates	171873 E 833093 N	172842 E 833132 N	174236 E 833171 N	171472 E 821987 N	172445 E 821987 N	174432 E 822071 N	177053 E 822071 N	178448 E 822071 N	179632 E 822240 N	181239 E 822156 N	175709 E 833248 N	167223 E 833054 N
Status	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Proposed
Aquifer	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn
Total Depth (ft)	765	702	722	707	700	722	702	720	720	642	652	760
Cased Depth (ft)	589	520	558	456	440	495	515	500	515	515	420	560
Well Diameter (in)	12	12	12	12	12	12	12	12	12	12	12	12
Pump Capacity (GPM)	625	515	620	600	575	525	755	600	600	475	700	700
Intake Depth (NGVD)	-80	-80	-80	-80	-80	-80	-80	-80	-80	-80	-80	-80
Year Drilled	1984	1984	1984	1984	1984	1984	1984	1984	1984	1984	1990	---

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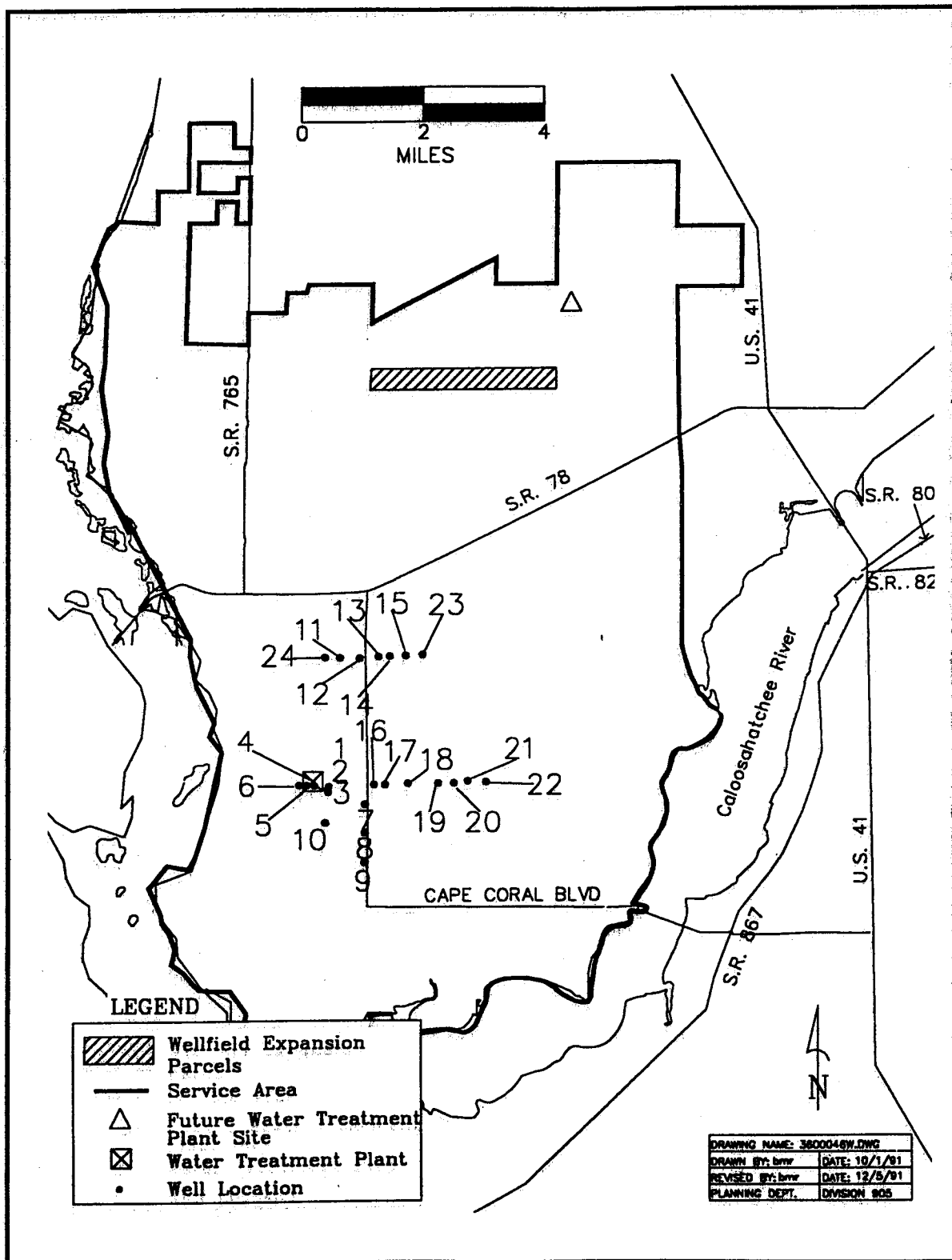


FIGURE E-15. Cape Coral Potable Water Supply Wells.

Lower West Coast Water Supply Plan -- Appendix E

Florida Cities College Parkway

SFWMD Permit Number: 36-00150-W
FDER PWS ID: 5360070

Raw Water Supply:

Raw water is withdrawn from 14 wells located in the vicinity of Cypress Lake Drive and College Parkway. The wells, which were drilled between 1970 and 1974, withdraw water from the mid-Hawthorn aquifer, and are between 8 and 12 inches in diameter. They have total depths between 220 and 285 feet, and cased depths between 100 and 220 feet. The design pumping capacities are between 80 and 150 GPM. Specific well information is given in Table E-16 and the location of the wells are identified in Figure E-16.

The current SFWMD permit was issued May 13, 1982 and expired May 13, 1992. The approved allocations are:

Annual Allocation*	3.35 BGY (9.17 MGD)
Maximum Daily Allocation	1.50 MGD

* The annual allocation includes withdrawals from the Florida Cities Green Meadows wellfield.

The 1990 average daily withdrawal was 0.53 MGD with a maximum day of 0.63 MGD.

The service area is located in the Lee County reduced threshold area.

Treatment Methods:

Treatment is provided by a 1.50 MGD (FDER rated capacity) lime softening treatment facility. This facility is located south of College Parkway and east of Summerlin Road in Fort Myers (Figure E-16). The 1990 average daily flow was 0.51 MGD and the maximum day flow was 0.62 MGD.

Interconnections:

There are three interconnections with two other potable water distribution systems. Two interconnections are with Lee County at Cypress Lake Drive and McGregor Boulevard (4 inches), and at U.S. 41 (Tamiami Trail) and Hendry Creek Drive (6 inches). One interconnect is with Gulf Utilities at Alico Road and Oriole Road.

Proposed:

An application is being processed by the SFWMD to construct 10 additional supply wells (5 sandstone aquifer and 5 water table wells) in the Green Meadows wellfield as indicated on Figure E-17. As a percent of pumpage, 70-75 percent of the water will come from the Sandstone aquifer while 25 to 30 percent will come from the water table aquifer. An increase in the annual allocation to 4.64 BGY (12.70 MGD - 11.20 MGD from Green Meadows wellfield and 1.5 MGD from Cypress Lakes wellfield) is requested. It is projected that a water demand of 12.00 MGD will exist by 1997. Specific well information on the proposed wells is located in Table E-17 and the location of the wells are identified in Figure E-16.

Future:

No future plans are available.

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Source:

Information was obtained from the Florida Cities Water Company and SFWMD water use permit files.

TABLE E-16. Florida Cities College Parkway (Cypress Lakes) Potable Water Supply Wells.

Well Number	2	3	4	5	6	7	8
Planar Coordinates	213510 E 804977 N	213009 E 804554 N	212574 E 805016 N	213811 E 806716 N	213573 E 806315 N	214806 E 807725 N	214345 E 807719 N
Status	Active	Reserve	Active	Active	Active	Active	Reserve
Aquifer	Mid-Hawthorn	Mid-Hawthorn	Mid-Hawthorn	Mid-Hawthorn	Mid-Hawthorn	Mid-Hawthorn	Mid-Hawthorn
Total Depth (ft)	230	220	220	238	260	220	224
Cased Depth (ft)	126	135	100	116	126	126	130
Well Diameter (in)	8	8	8	8	8	8	8
Pump Capacity (gpm)	100	*	100	80	70	100	110
Intake Depth (ft)	--	--	--	--	--	--	--
Year Drilled	1970	1974	1973	1969	1973	1972	1972

TABLE E-16. (Continued).

Well Number	12	13	14	15	16	17	18
Planar Coordinates	212754 E 807693 N	212319 E 807719 N	212345 E 808177 N	212535 E 809122 N	212897 E 810155 N	212436 E 810057 N	810170 N 210936 N
Status	Reserve	Reserve	Active	Reserve	Reserve	Active	Reserve
Aquifer	Mid-Hawthorn	Mid-Hawthorn	Mid-Hawthorn	Mid-Hawthorn	Mid-Hawthorn	Mid-Hawthorn	Mid-Hawthorn
Total Depth (ft)	220	220	220	220	220	285	280
Cased Depth (ft)	120	126	130	120	130	220	220
Well Diameter (in)	8	8	8	8	8	8	12
Pump Capacity (gpm)	*	*	90	*	*	120	*
Intake Depth (ft)	--	--	--	--	--	--	--
Year Drilled	1972	1972	1967	--	1974	1973	1973

* Pumps not installed.

Lower West Coast Water Supply Plan -- Appendix E

Florida Cities Green Meadows

SFWMD Permit Number: 36-00150-W
FDER PWS ID: 5360313

Raw Water Supply:

Raw water is withdrawn from 27 wells located in the vicinity of sections 33 to 36 of Range 26E, Township 45S, and sections 31 and 32 of Range 27E, Township 45S. Fourteen of the wells withdraw water from the water table aquifer, while 13 withdraw water from the sandstone aquifer. The water table wells are 10 inches in diameter, have total depths between 24 and 43 feet, cased depths between 17 and 23 feet, and were drilled between 1983 and 1991. Withdrawal capacities are 200 GPM per well. The sandstone wells are between 10 and 16 inches in diameter, have total depths between 92 and 245 feet, cased depths between 84 and 105 feet, and were drilled between 1974 and 1991. Withdrawal capacities are between 350 and 500 GPM. Specific well information is provided in Table E-17 and the location of the wells are identified in Figure E-16.

The current SFWMD permit was issued May 13, 1982 and expired May 13, 1992. The approved allocations are:

Annual Allocation*	3.35 BGY (9.17 MGD)
Maximum Daily Allocation	15.53 MGD

- * The annual allocation includes withdrawals from the Florida Cities Cypress Lakes wellfield.

The 1990 average daily withdrawal was 4.89 MGD with a maximum day of 5.94 MGD.

The service area is located in the Lee County reduced threshold area.

Treatment Method:

Treatment is provided by a 9 MGD (FDER rated capacity) lime softening treatment facility. This facility is located approximately eight miles east of U.S. 41 and north of Alico Road, Fort Myers (Figure E-16). The 1990 average daily flow was 5.19 MGD and the maximum day flow was 6.26 MGD.

Interconnections:

There are three interconnections with two other potable water distribution systems. There are two interconnections with Lee County at Cypress Lake Drive and McGregor Boulevard (4 inches) and U.S. 41 (Tamiami Trail) and Hendry Creek Drive (6 inches). The remaining interconnect is with Gulf Utilities at Alico Road and Oriole Road.

Proposed:

An application is being processed by the SFWMD to construct 10 additional supply wells (5 sandstone aquifer and 5 water table wells) in the Green Meadows wellfield as indicated on Figure E-16. As a percent of pumpage, 70-75 percent of the water will come from the Sandstone aquifer while 25-30 percent will come from the water table aquifer. An increase in the annual allocation to 4.64 BGY or 12.70 MGD (11.20 MGD from Green Meadows wellfield and 1.5 MGD from Cypress Lakes wellfield) is requested. It is projected that a water demand of 12.00 MGD will exist by 1997.

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Specific well information on the proposed wells is located in Table E-17 and the location of the wells are identified in Figure E-16.

Future:

Future plans are not available.

Source:

Information was obtained from the Florida Cities Water Company and the SFWMD water use permit files.

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TABLE E-17. Florida Cities Green Meadows Potable Water Supply Wells.

Well Number	1	1D	2	2A	3	3A	3B	4	4A	5	5A	6	6A
Planar Coordinates	262853 E 792637 N	262853 E 792637 N	263821 E 792182 N	263821 E 792182 N	263755 E 792923 N	263755 E 792923 N	263755 E 792923 N	265650 E 792218 N	265650 E 792218 N	267947 E 792224 N	267947 E 792224 N	270742 E 792196 N	270742 E 792196 N
Status	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Aquifer	Sand- stone	Water Table	Sand- stone	Water Table	Sand- stone	Water Table	Water Table	Sand- stone	Water Table	Sand- stone	Water Table	Sand- stone	Water Table
Total Depth (ft)	180	40	190	38	190	42	42	185	43	180	24	235	24
Cased Depth (ft)	170	14	110	20	100	17	22	105	20	102	20	90	20
Well Diameter (in)	10	10	10	10	16	10	10	16	10	16	10	16	10
Pump Capacity (gpm)	500	500	500	500	500	500	500	500	500	500	200	350	200
Intake Depth (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--
Year Drilled	1974	1983	1974	1983	1975	1983	1983	1975	1983	1981	1991	1981	1991

TABLE E-17. (Continued).

Well Number	7	7A	8	8A	9	9A	10	10A	11	11A	12	12A	13	13A
Planar Coordinates	273351 E 792329 N	273351 E 792329 N	275758 E 792218 N	275758 E 792218 N	278055 E 792224 N	278055 E 792224 N	280850 E 792196 N	280850 E 792196 N	283459 E 792329 N	283459 E 792329 N	286224 E 792184 N	286224 E 792184 N	288850 E 792305 N	288850 E 792305 N
Status	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Aquifer	Sand- stone	Water Table	Sand- stone	Water Table	Sand- stone	Water Table	Sand- stone	Water Table	Sand- stone	Water Table	Sand- stone	Water Table	Sand- stone	Water Table
Total Depth (ft)	170	45	190	42	230	42	200	40	210	40	90	25	92	25
Cased Depth (ft)	90	21	90	20	91	20	90	20	90	20	84	20	84	20
Well Diameter (in)	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Pump Capacity (gpm)	500	200	500	500	500	500	500	200	500	200	200	200	500	200
Intake Depth (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Year Drilled	1981	1991	1989	1989	1983	1983	1990	1990	1990	1990	1991	1991	1991	1991

TABLE E-17. (Continued).

Well Number	15	15A	16	16A	17	17A	18	18A	19	19A
Planar Coordinates	262813 E 794767 N	262813 E 794767 N	262746 E 797339 N	62746 E 797339 N	265569 E 797317 N	265569 E 797317 N	267975 E 797329 N	267975 E 797329 N	270655 E 797309 N	270655 E 797309 N
Status	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed
Aquifer	Sand- stone	Water Table	Sand- stone	Water Table	Sand- stone	Water Table	Sand- stone	Water Table	Sand- stone	Water Table
Total Depth (ft)		40		40		40		40		40
Cased Depth (ft)		20								
Well Diameter (in)	10	10	10	10	10	10	10	10	10	10
Pump Capacity (gpm)	500	200	500	200	500	200	500	200	500	200
Intake Depth (ft)	--	--	--	--	--	--	--	--	--	--
Year Drilled	--	--	--	--	--	--	--	--	--	--

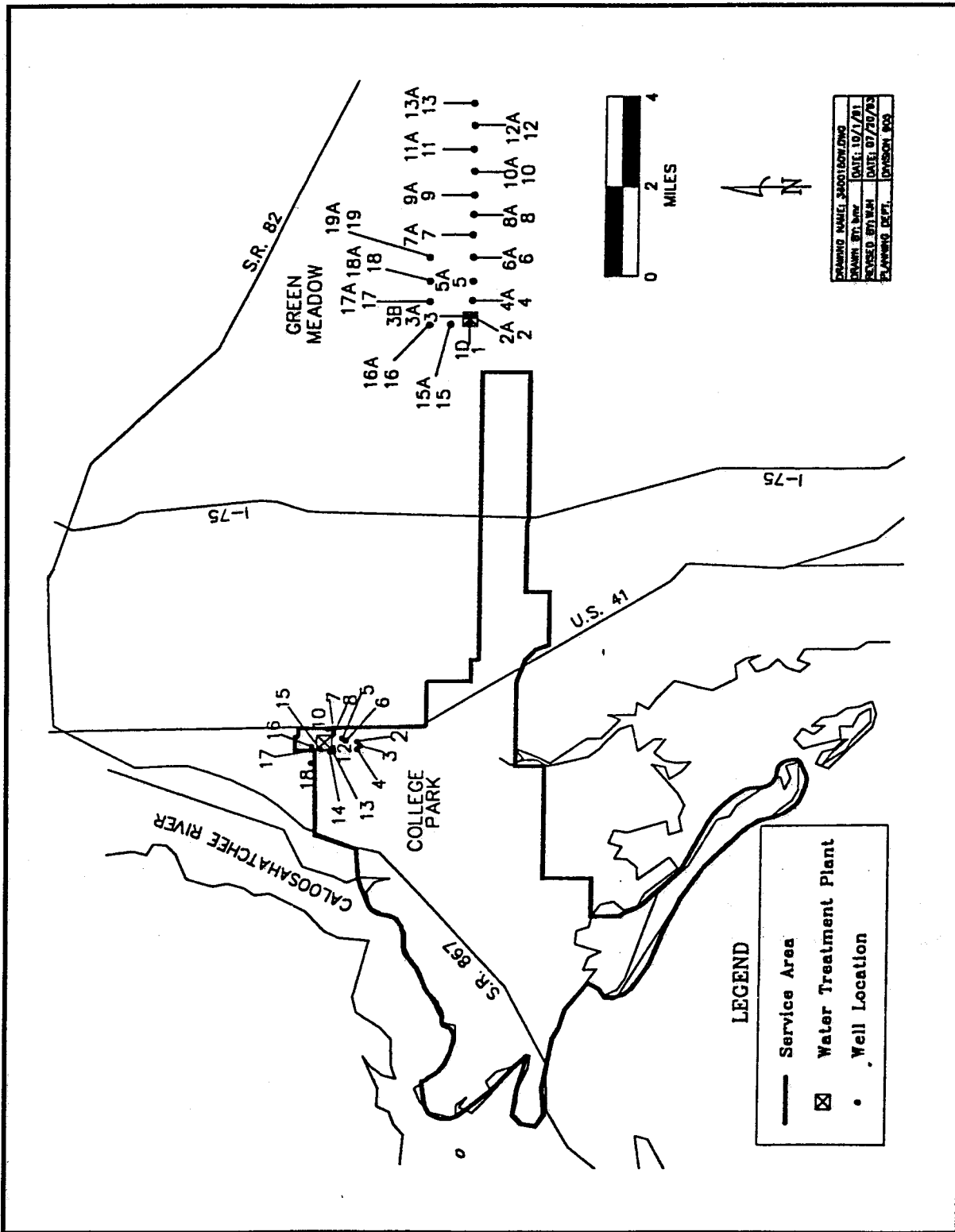


FIGURE E-16. Florida Cities College Parkway (Cypress Lakes) and Green Meadows Potable Water Supply Wells.

Lower West Coast Water Supply Plan -- Appendix E

Florida Cities Waterway Estates (North System)

SFWMD Permit Number: 36-00152-W
FDER PWS ID: 5360303

Raw Water Supply:

Raw water is withdrawn from 18 wells located in the Waterway Estates development and in North Cape Coral. The wells withdraw water from the water table aquifer and mid- and lower Hawthorn aquifers. They are 6-to-10 inches in diameter, have total depths between 45 and 600 feet, and cased depths between 15 and 300 feet. The wells were drilled between 1957 and 1991 and have withdrawal capacities between 25 and 125 GPM. Specific well information is given in Table E-18 and the location of the wells are identified in Figure E-17.

The current SFWMD permit was issued March 14, 1991 and expires April 12, 1995. The approved allocations are:

Annual Allocation:	467.60 MGY (1.28 MGD)
Maximum Daily Allocation:	1.68 MGD

The 1990 average daily withdrawal was 0.99 MGD with a maximum day of 1.13 MGD.

The service area is located in the Lee County reduced threshold area.

Treatment Method:

Treatment is provided by a 1.50 MGD (FDER rated capacity) lime softening treatment facility. This facility is located north of St. Clair Avenue and west of Orange Grove Boulevard, North Fort Myers (Figure E-17). The 1990 average daily flow was 0.90 MGD and the maximum day flow was 1.03 MGD.

Interconnections:

There are three interconnections with two other potable water distribution systems. Two interconnections are with Lee County at U.S. 41 and Pondella Road (6 inches) and the other at Pondella Road and Hancock Creek (6 inches). The other interconnect is with Cape Coral Utilities at Hancock bridge Parkway and 24th Avenue (10 inches).

Proposed:

N/A.

Future:

Various ground water sources are being considered for future water supply as well as purchasing water from Cape Coral.

Source:

Information was obtained from the Florida Cities Water Company and SFWMD water use permit files.

TABLE E-18. Florida Cities Waterway Estates Potable Water Supply Wells.

Well Number	1	2	3	4	6	8	9	10	11
Planar Coordinates	19921 E 842805 N	19906 E 842969 N	199812 E 842866 N	199801 E 843132 N	199812 E 842274 N	199230 E 842169 N	200714 E 842060 N	199898 E 843312 N	198474 E 843717 N
Status	Active	Active	Active	Active	Active	Active	Active	Active	Active
Aquifer	Water Table	Water Table	Mid- Hawthorn	Water Table	Mid- Hawthorn	Mid- Hawthorn	Mid- Hawthorn	Mid- Hawthorn	Mid- Hawthorn
Total Depth (ft)	45	57	120	48	225	113	230	235	230
Cased Depth (ft)	--	--	--	15	124	13	125	135	133
Well Diameter (in)	8	8	6	8	8	8	8	8	10
Pump Capacity (GPM)	89	70	25	89	80	89	80	25	80
Intake Depth (NGVD)	-42	--	-105	-30	-115	-30	-126	-126	-126
Year Drilled	1957	1957	1966	1966	1971	1976	1971	1972	1983

TABLE E-18. (Continued).

Well Number	12	13	14	15	D-1	D-2	N-1	N-2	N-9
Planar Coordinates	199097 E 843658 N	200267 E 843524 N	200683 E 843504 N	199472 E 846549 N	199911 E 842693 N	200311 E 842693 N	191844 E 854119 N	192409 E 852169 N	192343 E 852960 N
Status	Active	Active	Active	Active	Active	Standby	Active	Active	Active
Aquifer	Water Table	Water Table	Mid- Hawthorn	Mid- Hawthorn	Lower Hawthorn	Lower Hawthorn	Mid- Hawthorn	Mid- Hawthorn	Mid- Hawthorn
Total Depth (ft)	60	80	230	208	600	600	240	240	225
Cased Depth (ft)	40	50	165	160	300	295	140	140	164
Well Diameter (in)	10	10	10	10	4	12	8	8	10
Pump Capacity (GPM)	60	60	80	40	Flowing	Flowing	80	125	125
Intake Depth (NGVD)	-30	-62	-105	-105	--	--	-105	-126	-126
Year Drilled	1983	1983	1983	1988	1987	1991	1970	1975	1975

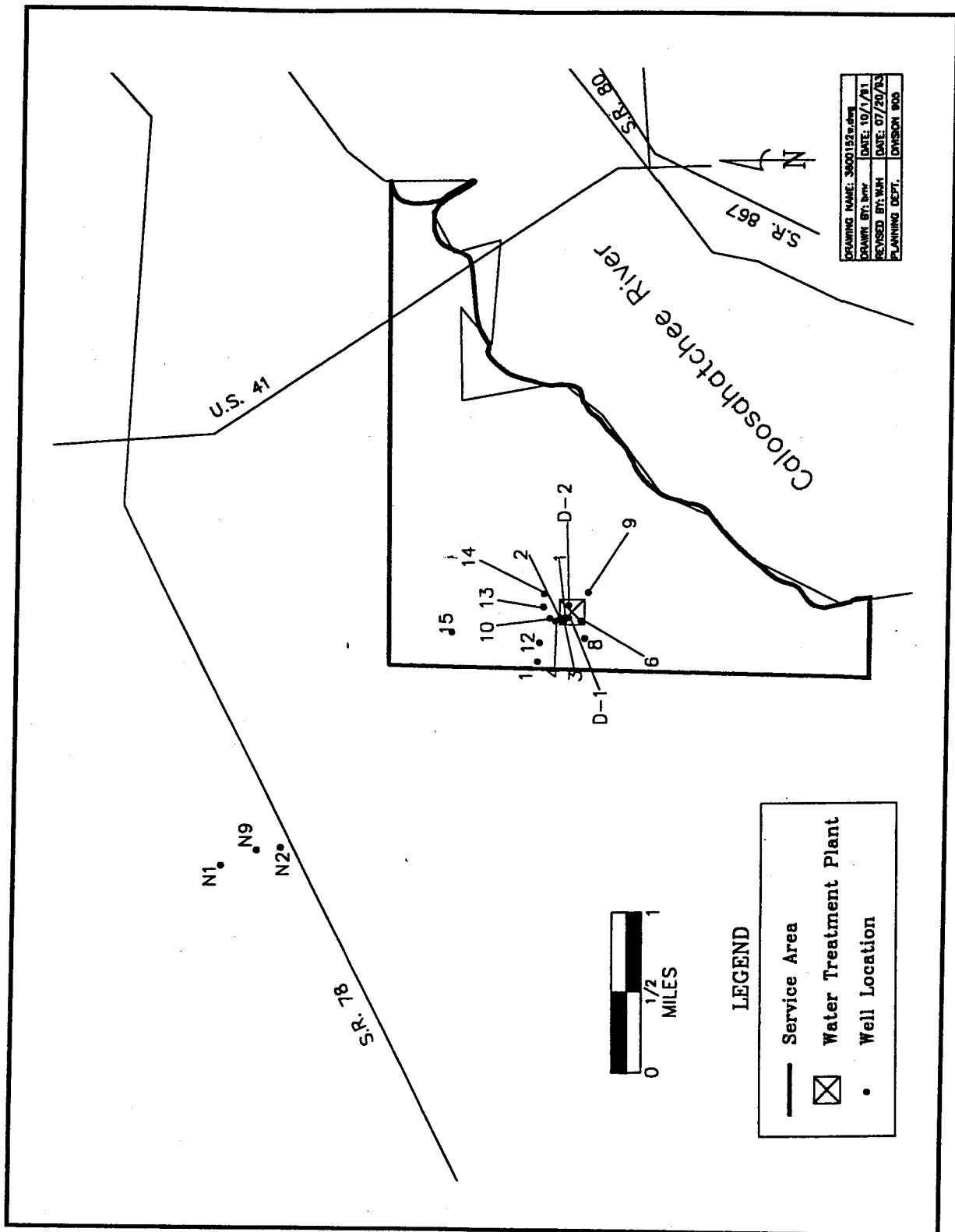


FIGURE E-17. Florida Cities Waterway Estates Potable Water Supply Wells.

Lower West Coast Water Supply Plan -- Appendix E

Fort Myers

SFWMD Permit Number: 36-00035-W
FDER PWS ID: 5360102

Raw Water Supply:

Raw water is withdrawn from 20 wells located on a 534 acre city-owned site west of Oritz Avenue, between Anderson Avenue and Colonial Boulevard, and north of Eastwood Golf Course. The wells, which were drilled in 1991, withdraw water from the water table aquifer and are 12 inches in diameter. They have total depths between 20 and 34 feet, cased depths between 6 and 13 feet and the withdrawal capacity of each well is 460 GPM. The wellfield is recharged with water from the Caloosahatchee River (C-43) via a river intake structure located three-quarters of a mile east of the W.P. Franklin Lock and Dam. The structure consists of two 10 MGD vertical turbine pumps, a 13-mile pipeline, and a network of canals that distribute the river water throughout the wellfield. The recharge system is operated to maintain the water level in the wellfield between 36 and 48 inches below the ground surface. Specific well information is provided in Table E-19 and the location of the wells are indicated in Figure E-18.

The current SFWMD permit was issued October 15, 1992 and expires October 15, 1997. The approved allocations are:

Surficial Aquifer

Annual Allocation:	3.26 BGY (8.92 MGD)
Maximum Daily Allocation:	12.48 MGD

C-43 Withdrawal

Annual Allocation:	3.26 BGY (8.92 MGD)
Maximum Daily Allocation:	17.47 MGD

The 1990 average daily wellfield withdrawal was 6.22 MGD with a maximum day of 9.98 MGD.

The city's service area is located in the Lee County reduced threshold area and is an area of special concern.

Treatment Method:

Existing treatment is provided by a 12 MGD (FDER rated capacity) membrane softening nanofiltration water treatment facility which has a 90 percent efficiency. Concentrate from this process is used for irrigation of the Eastwood Golf Course. This facility is located at the wellfield site (Figure E-18). The 1990 average daily water demand was 6.22 MGD and the maximum day flow was 9.98 MGD.

Interconnections:

The potable water distribution system has four interconnections with Lee County. They are:

<u>Location (City of Fort Myers)</u>	<u>Size (inches)</u>
Armeda Avenue & Prospect Street	6
Collins Street & Evans Avenue	8
Colonial Boulevard & Metro Parkway Boulevard	10
Nuna Avenue and New York Avenue	6

Lower West Coast Water Supply Plan -- Appendix E

Proposed:

N/A

Future:

The 1987 water system master plan update projected a year 2010 average daily water demand of 22.20 MGD with a maximum day flow of 31 MGD, based on typical local unit flows and projected unit growth for the area. A study of the existing wellfield indicates that it can produce a feasible production rate of 22.50 MGD with approximately 19.50 MGD of river water to the recharge canal system. The system would include a total of 33 wells and modifications to the river recharge system including additional pumping capacity and recharge canals. When the system capacity exceeds the ultimate capacity of the existing wellfield, a southeast wellfield site is proposed to be developed. This site is located in southeast Lee County, south of State Road 82 (Figure E-18). Membrane softening is proposed for future treatment plant expansions.

An expansion of this facility to 20 MGD is projected to be needed by 1995.

Source:

Information was obtained from the City of Fort Myers and SFWMD water use permit files.

Lower West Coast Water Supply Plan -- Appendix E

TABLE E-19. Fort Myers Potable Water Supply Wells.

Well Number	2	3	4	5	6	7	8	9	10	11
Planar Coordinates	233700 E 837407 N	233137 E 837649 N	233400 E 837023 N	232928 E 837204 N	233052 E 836748 N	232510 E 836784 N	232749 E 836368 N	232152 E 836437 N	232378 E 836026 N	233418 E 836593 N
Status	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Aquifer	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Total Depth (ft)	31	26	31	27	29	29	29	28	30	34
Cased Depth (ft)	10	10	8	8	10	13	10	11	10	9
Well Diameter (in)	12	12	12	12	12	12	12	12	12	12
Pump Capacity (gpm)	460	460	460	460	460	460	460	460	460	460
Intake Depth (ft)	---	---	---	---	---	---	---	---	---	---
Year Drilled	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991

TABLE E-19. (Continued).

Well Number	12	13	15	16	17	27	28	30	31	33
Planar Coordinates	233875 E 836436 N	233647 E 836077 N	233735 E 835653 N	233468 E 835290 N	232937 E 835446 N	231795 E 836089 W	232704 E 837627 N	233317 E 835752 N	232846 E 835939 N	233727 E 836837 N
Status	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Aquifer	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Total Depth (ft)	30	26	26	29	27	27	20	31	31	28
Cased Depth (ft)	10	10	11	9	10	12	6	9	10	9
Well Diameter (in)	12	12	12	12	12	12	12	12	12	12
Pump Capacity (gpm)	460	460	460	460	460	460	460	460	460	460
Intake Depth (ft)	---	---	---	---	---	---	---	---	---	---
Year Drilled	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991

Lower West Coast Water Supply Plan -- Appendix E

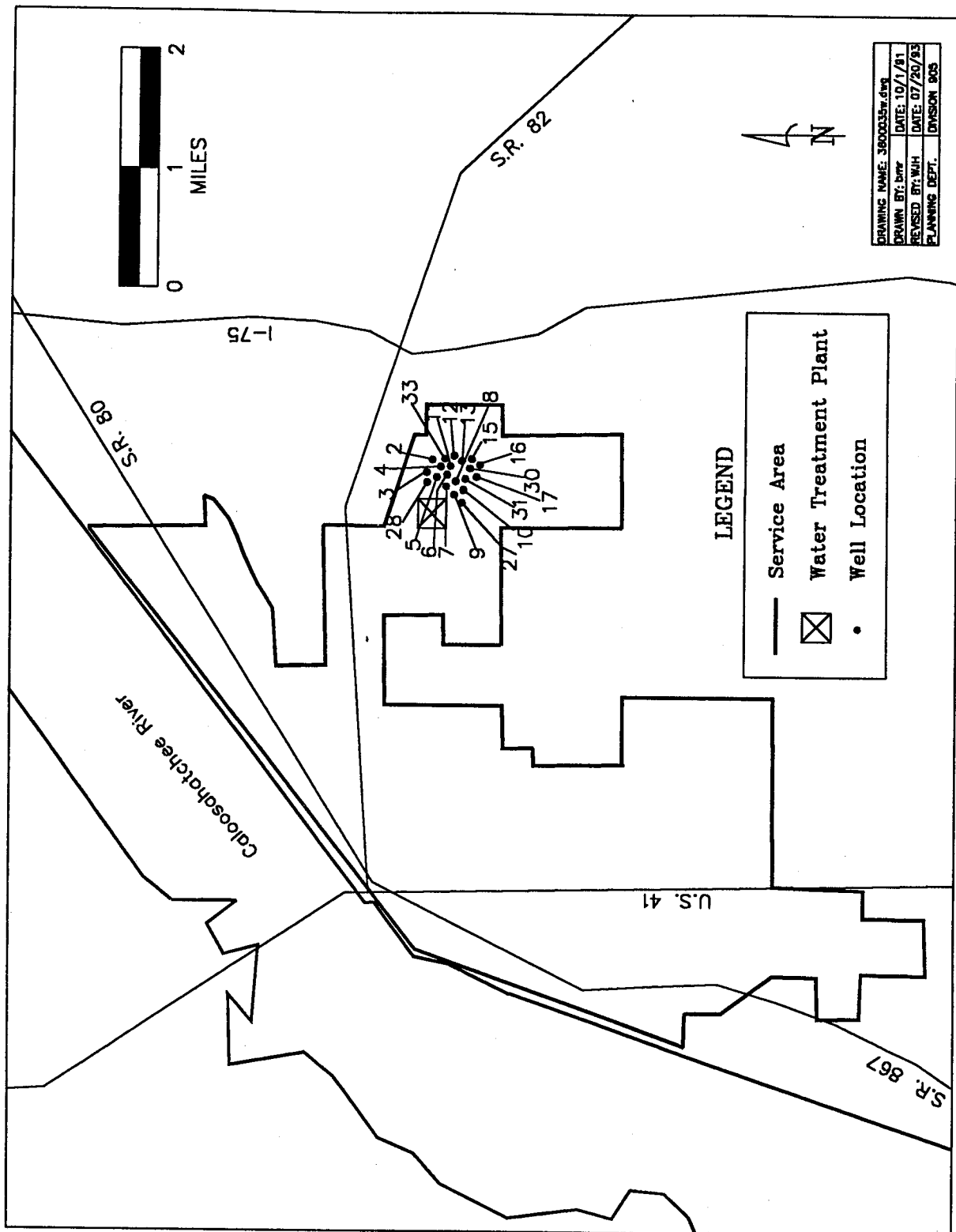


FIGURE E-18. Fort Myers Potable Water Supply Wells.

Lower West Coast Water Supply Plan -- Appendix E

Greater Pine Island Water Association

SFWMD Permit Number: 36-00045-W
FDER PWS ID: 5360322

Raw Water Supply:

Raw water is withdrawn from three lower Hawthorn aquifer wells located on Greater Pine Island. The wells have total depths between 737 and 770 feet, cased depths between 563 and 598 feet and were drilled in 1991 and 1992. Withdrawal capacities are 825 GPM per well. Specific well information is located in Table E-20 and the location of the wells can be found in Figure E-19. Previously, raw water is withdrawn from eleven wells located in Cape Coral. Two of the wells withdrew water from the lower Hawthorn aquifer while nine withdrew water from the mid-Hawthorn aquifer. The lower Hawthorn wells had total depths of 750 and 850 feet, cased depths of 450 and 350 feet, and were drilled in 1981 and 1978. Withdrawal capacities were 750 and 780 GPM. The mid-Hawthorn wells had total depths between 280 and 290 feet, cased depths between 82 and 86 feet and were drilled in 1965. Withdrawal capacities were between 90 and 120 GPM. This wellfield was deactivated in April of 1993 following startup of the water treatment facility and wellfield. The wells have been plugged and abandoned.

The current SFWMD permit was issued December 12, 1991 and expires December 12, 1996. The approved allocations are:

Annual Allocation	
Cape Coral Wellfield	
All Sources	479.35 MGY (1.31 MGD)
Mid Hawthorn	165.35 MGY (0.64 MGD)
Lower Hawthorn	314.00 MGY (0.71 MGD)
Island Wellfield	479.35 MGY (1.31 MGD)
Maximum Daily Allocation	
Cape Coral Wellfield	
All Sources	1.78 MGD
Mid Hawthorn	0.70 MGD
Lower Hawthorn	1.08 MGD
Island Wellfield	1.78 MGD

The 1990 average daily raw water withdrawal was 1.20 MGD with a maximum day of 1.55 MGD.

The service area is in the Lee County reduced threshold area.

Treatment Method:

Treatment consists of a new 1.50 MGD (FDER rated capacity) reverse osmosis (RO) water treatment facility. This facility was activated in April of 1993 and is located on Greater Pine Island. The location of this facility is shown in Figure E-19. The RO treatment facility has an efficiency of 85 percent with concentrate disposal via percolation ponds on the treatment facility site. Blend water percentages will be 12 percent initially, declining to approximately 8 percent in 2001.

The 1990 average daily flow was 0.88 MGD, with a maximum day flow of 1.30 MGD.

Lower West Coast Water Supply Plan -- Appendix E

Interconnections:

There is an abandoned Island Water Association 10-inch water line traversing Pine Island Sound which may be converted to an emergency interconnect. In addition, an 8-inch interconnect will be available with the City of Cape Coral in 1994.

Proposed:

N/A

Future:

Utility flow projections for this facility indicate a 2001 average daily raw water withdrawal of 1.45 MGD with a maximum day withdrawal of 1.85 MGD. The proposed construction and expansion schedule for this facility includes three 0.50 MGD expansions in 1999, 2005, and 2010.

Source:

Facility information was obtained from The Pine Island Water Association, Viro Group, Inc. (a division of Missimer & Associates), and SFWMD water use permit files.

Lower West Coast Water Supply Plan -- Appendix E

TABLE E-20. Greater Pine Island Potable Water Supply Wells.

Well Number	2	3	4	6	7	9	10
Planar Coordinates	168467 E 839489 N	168146 E 840105 N	168058 E 841311 N	168962 E 838851 N	169500 E 838864 N	169043 E 837862 N	169798 E 837456 N
Status	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged
Aquifer	Mid-Hawthorn	Mid-Hawthorn	Mid-Hawthorn	Mid-Hawthorn	Mid-Hawthorn	Mid-Hawthorn	Mid-Hawthorn
Total Depth (ft)	280	280	290	290	290	280	280
Cased Depth (ft)	85	84	84	84	84	86	82
Well Diameter (in)	6	6	6	6	6	6	6
Pump Capacity (gpm)	100	100	110	110	120	90	100
Intake Depth (ft)	60-70	60-70	60-70	60-70	60-70	60-70	60-70
Year Drilled	1965	1965	1965	1965	1965	1965	1965

TABLE E-20. (Continued).

Well Number	11	12	RO 2	RO 3	RO 4	RO 5	RO 6	RO 7
Planar Coordinates	168310 E 837898 N	169801 E 838203 N	161793 E 839108 N	161810 E 838918 N	137237 E 823434 N	136918 E 823301 N	136782 E 823448 N	137145 E 823190 N
Status	Plugged	Plugged	Plugged	Plugged	Active	Active	Active	Future
Aquifer	Mid-Hawthorn	Mid-Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn
Total Depth (ft)	280	280	850	750	739	770	737	--
Cased Depth (ft)	85	84	350	450	583	563	598	--
Well Diameter (in)	6	6	12	10	12	12	12	--
Pump Capacity (gpm)	110	90	750	780	825	825	825	--
Intake Depth (ft)	60-70	60-70	60-70	60-70	55	55	77	--
Year Drilled	1965	1965	1978	1981	1991	1991	1992	--

Lower West Coast Water Supply Plan -- Appendix E

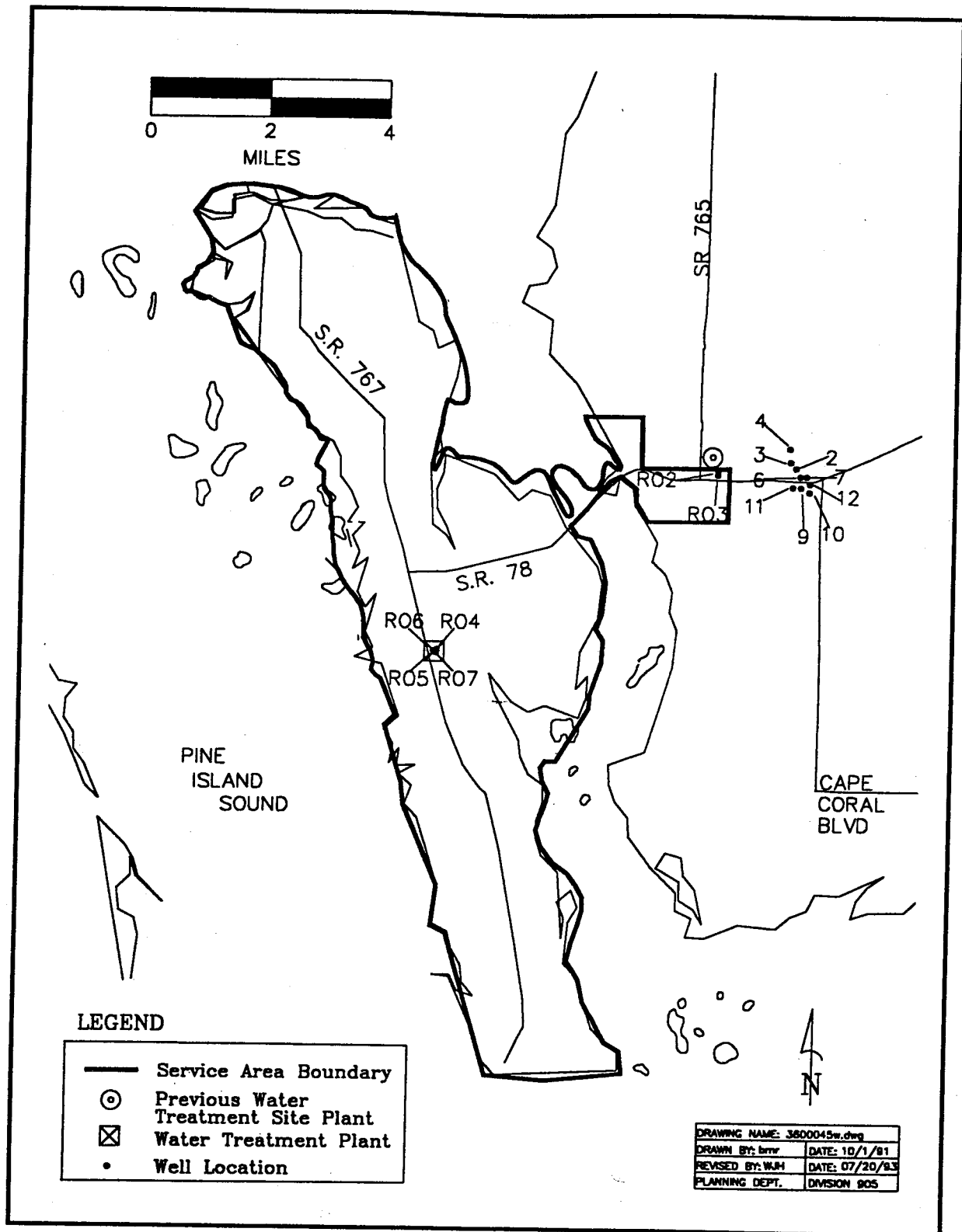


FIGURE E-19. Greater Pine Island Potable Water Supply Wells.

Lower West Coast Water Supply Plan -- Appendix E

Gulf Utility Corkscrew

SFWMD Permit Number: 36-00122-W
FDER PWS ID: 5364097

Raw Water Supply:

Raw water is withdrawn from 12 wells located in northern Estero. The wells withdraw water from the water table and sandstone aquifers. There are 11 water table wells which are 16 inches in diameter, have total depths between 30 and 42 feet, cased depths between 16 and 22 feet, and were drilled in 1988. The withdrawal capacities are 450 GPM each. There is one sandstone well which is 6 inches in diameter, has a total depth of 123 feet, a cased depth of 83 feet, and was drilled in 1990. The withdrawal capacity is 60 GPM. Specific well information is given in Table E-21 and the location of the wells are identified in Figure E-20.

The current SFWMD permit was issued July 11, 1991 and expires July 11, 1996. The approved allocations are:

Annual Allocation:*	865.00 MGY (2.37 MGD)
Maximum Daily Allocation:	
All Sources:*	3.15 MGD
Water Table Aquifer:	1.05 MGD
Sandstone Aquifer:	0.35 MGD

- * The annual allocation includes withdrawals from the Gulf Utility San Carlos wellfield and from wells identified in the proposed section.

The service area is located in the Lee County reduced threshold area.

Treatment Method:

Treatment is provided by a 0.50 MGD (FDER rated capacity) membrane softening treatment facility. The location of this water treatment plant is shown in Figure E-22. This facility has an efficiency of 80 percent. Concentrate disposal is via blending with the reclaimed water from the Gulf Utility Three Oaks wastewater treatment facility which is utilized for irrigation on the Village of Country Creek and Vines golf courses. This facility was placed into service recently. No flow information is available.

Interconnections:

The service area has two existing interconnects with Florida Cities Water Company's South system at Lee Road and Alico Road and the other along Island Park Road.

Proposed:

The referenced permit approved four additional sandstone aquifer wells. These wells will be six inches in diameter, have total depths of 125 feet and cased depths of 85 feet. The withdrawal capacity will be 60 GPM. Specific well information is located in Table E-21 and the location of the wells are identified in Figure E-20.

Future:

This facility will have an ultimate capacity of 3 MGD. To achieve this, five 0.50 MGD expansions are projected to occur in 1993, 1996, 1999, 2002 and 2005.

Lower West Coast Water Supply Plan -- Appendix E

The water demand for the Gulf Utility service area is projected to increase to 3.15 MGD average daily demand with a maximum day demand of 4.20 MGD by 2001.

Source:

Information was obtained from Gulf Utility and SFWMD water use permit files.

TABLE E-21. Gulf Utility Corkscrew Potable Water Supply Wells.

Well Number	1	2	3	4	5	6	7	8
Planar Coordinates	252898 E 761653 N	252870 E 761218 N	252882 E 760767 N	252959 E 760289 N	252915 E 759887 N	252900 E 759230 N	252153 E 759049 N	251673 E 759136 N
Status	Existing	Existing	Existing	Existing	Existing	Existing	Existing	Existing
Aquifer	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Total Depth (ft)	31	40	40	39	42	32	39	30
Cased Depth (ft)	16	19	19	19	20	22	19	20
Well Diameter (in)	16	16	16	16	16	16	16	16
Pump Capacity (GPM)	450	450	450	450	450	450	450	450
Intake Depth (ft)	--	--	--	--	--	--	--	--
Year Drilled	1988	1988	1988	1988	1988	1988	1988	1988

TABLE E-21. (Continued).

Well Number	9	10	11	12	17	18	19	20
Planar Coordinates	251130 E 759144 N	250368 E 759173 N	249603 E 759182 N	252760 E 766565 N	252060 E 764694 N	252201 E 761793 N	252197 E 759239 N	250986 E 759161 N
Status	Existing	Existing	Existing	Existing	Proposed	Proposed	Proposed	Proposed
Aquifer	Water Table	Water Table	Water Table	Sandstone	Sandstone	Sandstone	Sandstone	Sandstone
Total Depth (ft)	30	30	30	123	125	125	125	125
Cased Depth (ft)	21	18	17	83	85	85	85	85
Well Diameter (in)	16	16	16	6	6	6	6	6
Pump Capacity (GPM)	450	450	450	60	60	60	60	60
Intake Depth (ft)	--	--	--	--	--	--	--	--
Year Drilled	1988	1988	--	1990	--	--	--	--

Lower West Coast Water Supply Plan -- Appendix E

Gulf Utility San Carlos

SFWMD Permit Number: 36-00122-W
FDER PWS ID: 5360243

Raw Water Supply:

Raw water is withdrawn from four wells located in San Carlos Park. The wells, which were constructed in 1980 and 1984, withdraw water from the water table aquifer, are 8 inches in diameter, have total depths between 40 and 45 feet, and cased depths between 18 and 22 feet. The withdrawal capacities are between 211 and 283 GPM. Specific well information is provided in Table E-22 and the location of the wells are identified in Figure E-20.

The current SFWMD permit was issued July 11, 1991 and expires July 11, 1996. The approved allocations are:

Annual Allocation: *	865.00 MGY (2.37 MGD)
Maximum Daily Allocation:	
All Sources:*	3.15 MGD
Water Table Aquifer:	1.75 MGD

* The annual allocation includes withdrawals from the Gulf Utility Corkscrew wellfield.

The service area is located in the Lee County reduced threshold area.

Treatment Method:

Treatment is provided by a 2.50 MGD (FDER rated capacity) lime softening treatment facility. The location of this water treatment plant is shown in Figure E-20. The 1990 average daily flow was 1.46 MGD.

Interconnections:

The service area has two existing interconnects with Florida Cities Water Company's South system at Lee Road and Allico Road and the other along Island Park Road.

Proposed:

N/A

Future:

The water demand for the Gulf Utility service area is projected by the utility to increase to 3.15 MGD average daily demand with a maximum day demand of 4.20 MGD by 2001. To meet this demand, a new membrane softening treatment facility known as Gulf Utility Corkscrew has been constructed in Estero.

Source:

Information was obtained from Gulf Utility and SFWMD water use permit files.

Lower West Coast Water Supply Plan -- Appendix E

TABLE E-22. Gulf Utility San Carlos Potable Water Supply Wells.

Well Number	13	14	15	16
Planar Coordinates	239211 E 780782 N	239199 E 781178 N	239198 E 781825 N	239210 E 782620 N
Status	Active	Active	Active	Active
Aquifer	Water Table	Water Table	Water Table	Water Table
Total Depth (ft)	41	45	40	40
Cased Depth (ft)	19	22	18	19
Well Diameter (in)	8	8	8	8
Pump Capacity (GPM)	283	266	283	211
Intake Depth (ft)	--	--	--	--
Year Drilled	1980	1984	1980	1980

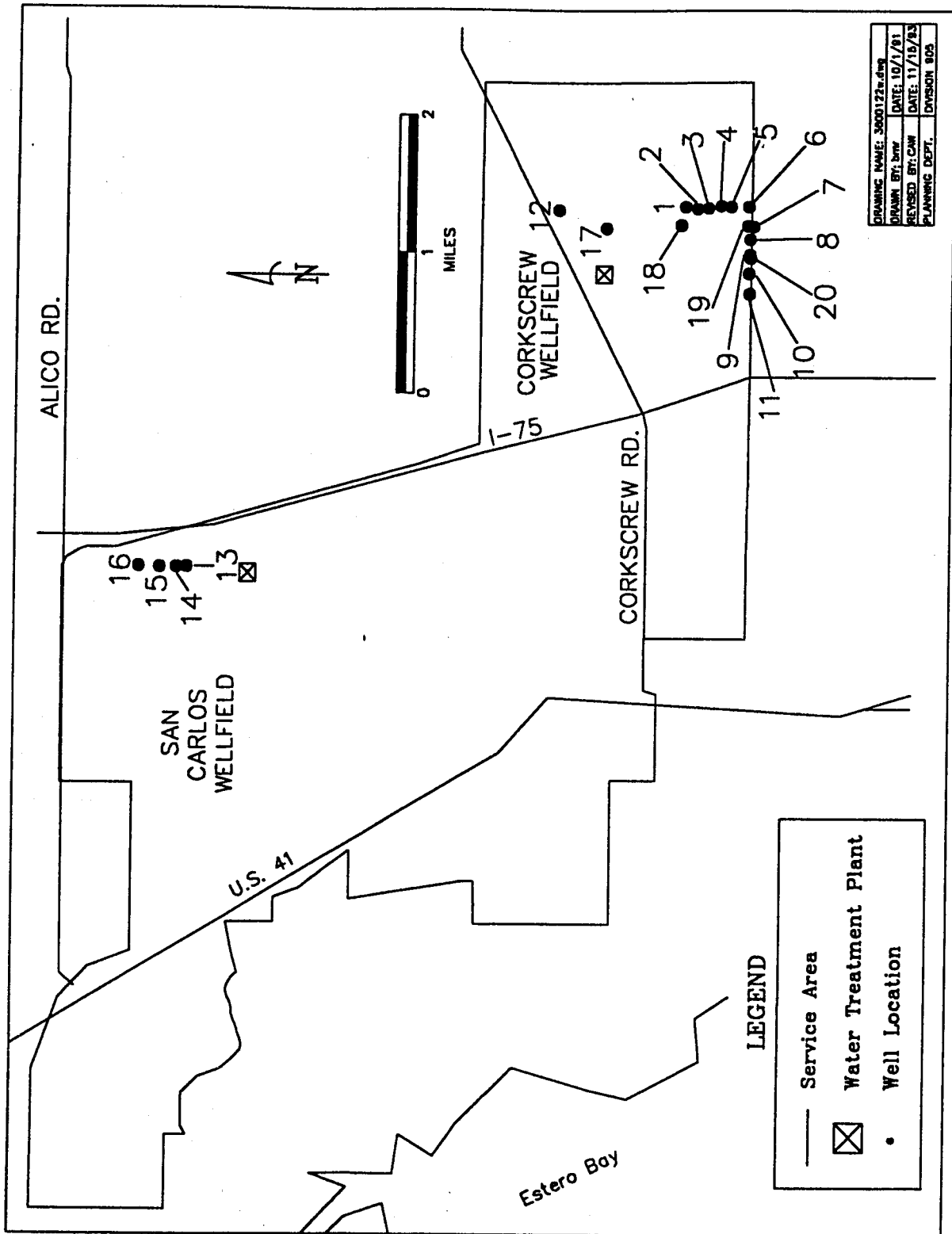


FIGURE E-20. Gulf Utility Corkscrew and San Carlos Potable Water Supply Wells.

Lower West Coast Water Supply Plan -- Appendix E

The Island Water Association

SFWMD Permit Number: 36-00034-W
FDER PWS ID: 5360146

Raw Water Supply:

Raw water is withdrawn from 19 wells located on Sanibel Island. The wells, which were drilled between 1973 and 1991, withdraw water from the lower Hawthorn and Suwannee aquifers, are 4 to 12 inches in diameter, have total depths between 574 to 770 feet, and cased depths between 440 and 668 feet. The withdrawal capacities range from 30 to 525 GPM. The lower Hawthorn aquifer was used for raw water supply to the electrodialysis (ED) plant and the Suwannee aquifer is used for raw water supply to the reverse osmosis plant as well as a portion of the ED raw water supply. Specific well information is provided in Table E-23 and the location of the wells can be found in Figure E-21.

The current SFWMD permit was issued December 10, 1992 and expires December 10, 1997. The approved allocations are:

Annual Allocation:	1.49 BGY (4.08 MGD)
Maximum Daily Allocation:	6.16 MGD

Three of the wells are designated as reserve while one is indicated as standby. Reserve wells do not have pumps installed and would require some modifications to make them operational, while standby wells are operational, but not utilized on a regular basis.

This service area is in the Lee County reduced threshold area.

Treatment Method:

Treatment is provided by a 4.7 MGD reverse osmosis plant (FDER rated capacity). The reverse osmosis plant was recently modified to increase its capacity to 4.7 MGD. The facilities are located at the intersection of San-Cap Road and Rabbit Road on Sanibel Island (Figure E-21). The brine reject is disposed via an outfall 600 feet offshore into the Gulf of Mexico. The combined treatment plant efficiency is approximately 80 percent. The 1990 finished water system average daily flow was 3 MGD (0.53 MGD ED, 2.47 MGD RO) and the maximum day flow was 4.68 MGD. There was a 1.17 MGD electrodialysis plant that has been removed from service and its capacity will be replaced via expansion to the RO capacity.

Interconnections:

An existing abandoned 10-inch water supply main with the Pine Island Water Association's system is proposed to be converted to an emergency interconnect. The feasibility of this is being evaluated.

Proposed:

Three additional Suwannee wells are permitted and planned to be drilled in 1995.

Future:

Additional water supply for increased demands is proposed to come from four Suwannee wells located in the vicinity of the existing wells (Figure E-21). The existing treatment facility is considered adequate to serve buildout water demands.

Lower West Coast Water Supply Plan -- Appendix E

Source:

Information was obtained from The Island Water Association and SFWMD water use permit files.

Lower West Coast Water Supply Plan -- Appendix E

TABLE E-23. Island Water Association Potable Water Supply Wells.

Well Number	H3	H5	H6	H7	H8	H9	H10	H12	H13	H14	H15
Planar Coordinates	137154E 768267N	140823E 766912N	142055E 766627N	142988E 766519N	143984E 766434N	144722E 766489N	145417E 766684N	134684E 769432N	138608E 766919N	133011E 769760N	122708E 776511N
Status	Active ED	Active ED	Reserve	Reserve	Standby	Active ED	Active ED	Active ED/RO	Active ED	Active ED	Reserve
Aquifer	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn	Lower Hawthorn
Total Depth (ft)	651	676	700	702	678	675	625	650	588	605	610
Cased Depth (ft)	561	508	647	642	508	504	500	610	502	505	440
Well Diameter (in)	4	6	6	6	6	6	10	10	10	8	10
Pump Capacity (gpm)	250	30	250	250	250	250	350	250	130	250	250
Intake Depth (ft)	80	80	--	--	80	80	80	140	140	140	140
Year Drilled	1973	1975	1975	1975	1975	1975	1975	1977	1982	1988	1978

TABLE E-23. (Continued).

Well Number	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11
Planar Coordinates	136902E 767590N	137228E 767612N	136777E 767752N	135193E 768752N	129774E 770938N	130436E 770938N	130182E 769923N	124739E 774373N	122794E 776983N	122601E 777271N	122413E 777572N
Status	Active RO	Active RO	Active RO	Active ED/RO	Active ED/RO	Active RO	Active RO	Active RO	Proposed RO	Proposed RO	Proposed RO
Aquifer	Suwannee	Suwannee	Suwannee	Suwannee	Suwannee	Suwannee	Suwannee	Suwannee	Suwannee	Suwannee	Suwannee
Total Depth (ft)	716	696	705	720	770	770	770	750	750	750	750
Cased Depth (ft)	660	661	660	668	664	649	639	618	620	620	620
Well Diameter (in)	12	8	10	10	10	10	10	10	10	10	10
Pump Capacity (gpm)	525	525	525	525	525	525	525	525	525	525	525
Intake Depth (ft)	140	140	140	145	160	160	160	160	160	160	160
Year Drilled	1978	1979	1981	1984	1985	1988	1988	1991	---	---	---

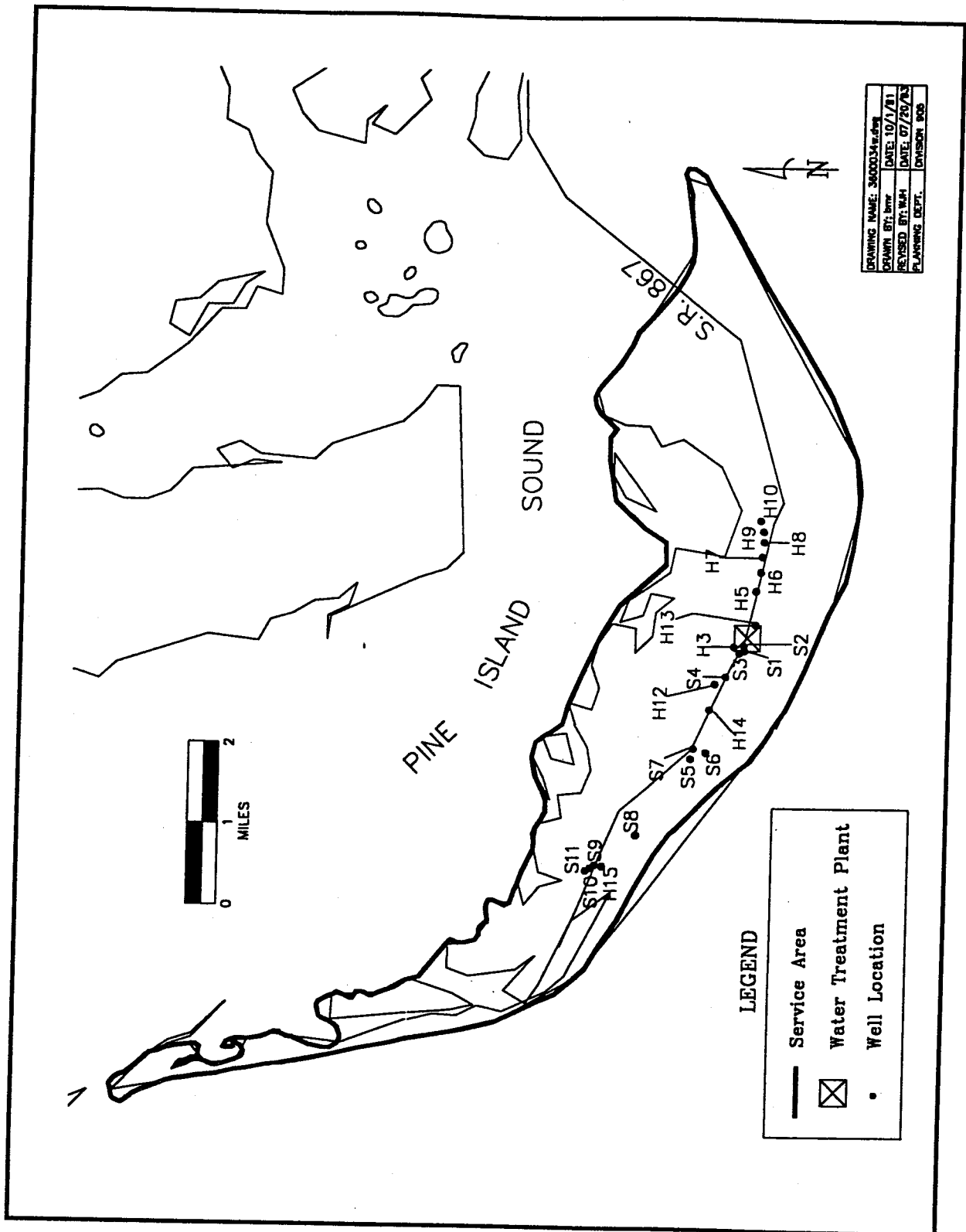


FIGURE E-21. Island Water Association Potable Water Supply Wells.

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Lee County Utilities Corkscrew

SFWMD Permit Number: 36-00003-W
FDER PWS ID: 5364048

Raw Water Supply:

Raw water is withdrawn from 23 wells located in the vicinity of the water treatment plant in the southeastern portion of the county. The wells withdraw water from the sandstone and water table aquifers, and are 12 inches in diameter. There are 17 water table wells that have total depths between 105 and 150 feet, cased depths between 35 and 60 feet, and were drilled in 1980 and 1982. The withdrawal capacity of each water table well is 500 GPM. There are six sandstone wells that have total depths between 205 and 300 feet, cased depths between 135 and 210 feet, and were drilled in 1980. The withdrawal capacities of each sandstone well is 350. Specific well information is provided in Table E-24 and the location of all wells can be found in Figure E-22.

The current SFWMD permit was issued January 7, 1982 and expired January 7, 1992. The approved allocations are:

Annual Allocation:	3.65 BGY (10.00 MGD)
Maximum Daily Allocation:	19.10 MGD

The service area is located in the Lee County reduced threshold area.

Treatment Method:

Treatment is provided by a 10 MGD (FDER rated capacity) lime softening treatment facility. This facility is located at 16101 Alco Road, Fort Myers (Figure E-22). The 1990 average daily flow was 5.56 MGD, with a maximum day flow of 8.58 MGD.

Interconnections:

The water distribution system has eight interconnects, four with Fort Myers and four with Florida Cities Water Company. They are:

<u>Location</u>	<u>Size (inches)</u>
<u>City of Fort Myers</u>	
Armeda Avenue & Prospect Street	6
Collins Street & Evans Avenue	8
Colonial Boulevard & Metro Parkway Boulevard	10
Nuna Avenue and New York Avenue	6
<u>Florida Cities Waterway Estates (North System)</u>	
U.S. 41 & Pondella Road	6
Pondella Road & Betmar Boulevard	6
<u>Florida Cities South Fort Myers</u>	
U.S. 41 & Old Gladiolus Drive	6
McGregor Boulevard & Cypress Lake Drive	4

In addition to these, interconnects also exist between this facility and the Lee County Olga service area.

Proposed:

An application to modify this permit is under review by the SFWMD. Lee County indicates that their 1998 annual potable water demand is expected to increase to 13.37 MGD. The demand is expected to be satisfied by 3.42 MGD from the Olga water treatment plant and 9.95 MGD from the Corkscrew water treatment plant. The

Lower West Coast Water Supply Plan -- Appendix E

application requests the current allocations except for an increase of 0.30 MGD in maximum day at Corkscrew.

This application also proposes to expand the Corkscrew wellfield with the addition of eight wells. The wells will be located in four clusters, with each cluster consisting of one sandstone well and one water table well. Specific well information is located in Table E-24 and the location of these wells are identified in Figure E-20. The purpose of the wellfield expansion is to limit expected drawdowns in the water table aquifer to less than one foot under existing wetlands, while increasing the water supply as needed to meet projected demands.

The county is also planning to construct a second river crossing to serve the north Fort Myers area. The pipeline will be attached to the Edison Bridge, which is under construction. The primary source of water for this pipeline will be the Corkscrew facility.

Future:

The Department of Lee County Utilities' 20-Year Master Plan dated November 1991 indicates that the Corkscrew facility will have an ultimate capacity of 25 MGD. This will be accomplished through an immediate expansion to 15 MGD and expansions to 20 MGD and 25 MGD in 1997 and 2007, respectively. The 5 MGD immediate expansion has been delayed pending development of the LWC Water Supply Plan. The proposed treatment process will remain lime softening and the raw water source will be through expansion of the existing wellfield. The wellfield will consist of an additional 25 wells (16 water table and 9 limestone wells) to the existing wells located in a 16 square mile area south of the existing wellfield. It is proposed that 75 percent of the water will come from the water table aquifer while the remaining 25 percent will come from the sandstone aquifer.

The Olga treatment plant is proposed to remain at 5 MGD. Lee County is investigating the feasibility of constructing an artificial aquifer recharge system and wellfield in the Lehigh Acres area which would utilize water from the Caloosahatchee River. The utility believes that the proposed wellfield would be a more reliable source of water during drought periods.

The plan also proposes to construct a new treatment facility in the North Fort Myers area north of the river and east of U.S. 41. The initial capacity will be 5 MGD, when constructed in 2000, and will later be expanded to 10 MGD after 2010. The treatment process will be desalination with raw water from the lower Hawthorn. The wellfield will ultimately consist of 18 production wells and a withdrawal of 12 MGD.

Source:

Information was obtained from the Department of Lee County Utilities and SFWMD water use permit files.

TABLE E-24. Lee County Corkscrew Wellfield Potable Water Supply Wells.

Well Number	1	2	3	4	5	6	7	8	9	10	11	12
Planar Coordinates	269765 E 773808 N	271683 E 774278 N	273369 E 774752 N	269867 E 770126 N	271720 E 770076 N	273462 E 770075 N	269827 E 771103 N	270692 E 771140 N	271625 E 771164 N	272496 E 771175 N	273381 E 771225 N	269716 E 770131 N
Status	Out of Service	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Aquifer	Sand- stone	Sand- stone	Sand- stone	Sand- stone	Sand- stone	Sand- stone	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Total Depth (ft)	205	250	270	295	295	300	135	140	140	150	145	140
Cased Depth (ft)	135	160	180	185	205	210	45	50	55	60	55	50
Well Diameter (in)	12	12	12	12	12	12	12	12	12	12	12	12
Pump Capacity (gpm)	350	350	350	350	350	350	500	500	500	500	500	500
Intake Depth (ft)	100	100	100	100	100	100	40	40	45	45	45	45
Year Drilled	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980

TABLE E-24. (Continued).

Well Number	13	14	15	16	18	19	20	21	22	23	24
Planar Coordinates	270709 E 770157 N	271596 E 770100 N	272486 E 770094 N	273357 E 770073 N	270504 E 773165 N	271578 E 773135 N	272459 E 773186 N	270427 E 773948 N	271476 E 774207 N	272349 E 774477 N	273114 E 774721 N
Status	Active	Active	Active	Active	Active	Active	Active	Active	Out of Service	Active	Active
Aquifer	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Total Depth (ft)	140	150	145	150	115	120	120	105	110	115	120
Cased Depth (ft)	50	55	55	60	45	50	50	35	40	45	50
Well Diameter (in)	12	12	12	12	12	12	12	12	12	12	12
Pump Capacity (gpm)	500	500	500	500	500	500	500	500	500	500	500
Intake Depth (ft)	45	45	45	45	40	45	45	30	35	40	45
Year Drilled	1980	1980	1980	1980	1982	1982	1982	1982	1982	1982	1982

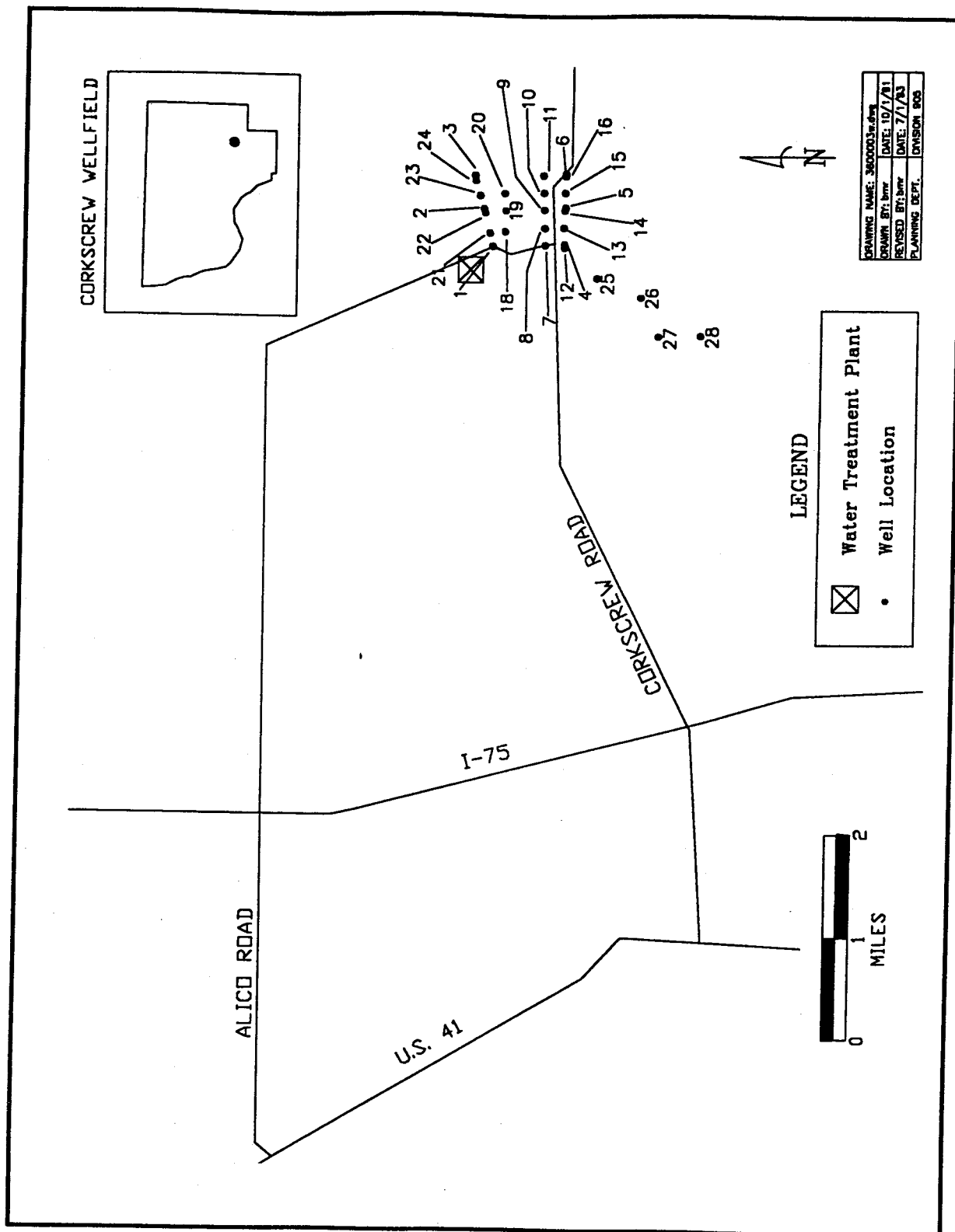


FIGURE E-22. Lee County Corkscrew Potable Water Supply Wells.

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North Fort Myers Emergency Wellfield and Treatment Facility

SFWMD Permit Number: 36-00178-W

Raw Water Supply:

Raw water is withdrawn from two wells located at the 2 million gallon finished water reservoir in North Fort Myers. The wells withdraw water from the sandstone and mid-Hawthorn aquifers, are 8 inches in diameter, have total depths of 198 and 105 feet, and cased depths of 138 and 64 feet, respectively. The wells were drilled in 1979. The design pumping capacities are 15 and 125 GPM, respectively. Specific well information is given in Table E-25 and the location of the wells can be found in Figure E-23.

The current SFWMD permit was issued August 11, 1988 and expired January 7, 1992. The approved allocations are:

Maximum Daily Allocation: 0.20 MGD

It is further allocated that a maximum day withdrawal of 0.18 MGD from the mid-Hawthorn and 0.02 from the sandstone has been allocated. An annual allocation is not stated because the wells are for emergency short-term use only. This facility is to be used only when the Olga water treatment plant cannot deliver enough water to the 2 million gallon reservoir.

Treatment Method:

This is an emergency facility which consists of an aeration treatment process, with the finished water blended with water from the Olga plant in a 2 million gallon storage tank. This facility is located at the intersection of Old Bayshore Road and Bayshore Road in North Fort Myers (Figure E-23). This system has not been used in the past couple of years.

Interconnections:

This is an emergency facility only. Interconnects for the distribution system can be found in the Lee County Utilities Olga and Corkscrew utility capsules.

Proposed:

An application to modify their permit is under review by the SFWMD. Lee County indicates their 1998 annual potable water demand is expected to increase to 13.37 MGD with a maximum day of 19.36 MGD. The demand is expected to be satisfied by 3.42 MGD from the Olga WTP and 9.95 MGD from the Corkscrew WTP. The North Fort Myers facilities are proposed to remain as a backup system. The application requests the current allocations except for an increase of 0.30 MGD in the maximum day at Corkscrew.

The county is also planning to construct a second river crossing to serve the North Fort Myers area. The pipeline will be attached to the Edison Bridge, which is under construction. The primary source of water for this pipeline will be the Corkscrew facility.

Future:

The Department of Lee County Utilities 20-Year Master Plan dated November, 1991 indicates a new treatment facility will be constructed in the North Fort Myers area north of the river and east of U.S. 41. The initial capacity will be 5 MGD constructed in 2000 which will later be expanded to 10 MGD after 2010. The treatment process

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will be desalination with raw water from the Lower Hawthorn. The wellfield will ultimately consist of 18 production wells and a withdrawal of 12 MGD.

Source:

Information was obtained from the Department of Lee County Utilities and SFWMD water use permit files.

TABLE E-25. Lee County North Fort Myers Emergency Facility Potable Water Supply Wells.

Well Number	1	2
Planar Coordinates	226702 E 865374 N	226675 E 865253 N
Status	Active	Active
Aquifer	Mid-Hawthorn	Sandstone
Total Depth (ft)	198	105
Cased Depth (ft)	138	64
Well Diameter (in)	8	8
Pump Capacity (GPM)	125	15
Intake Depth (ft)	60	60
Year Drilled	1979	1979

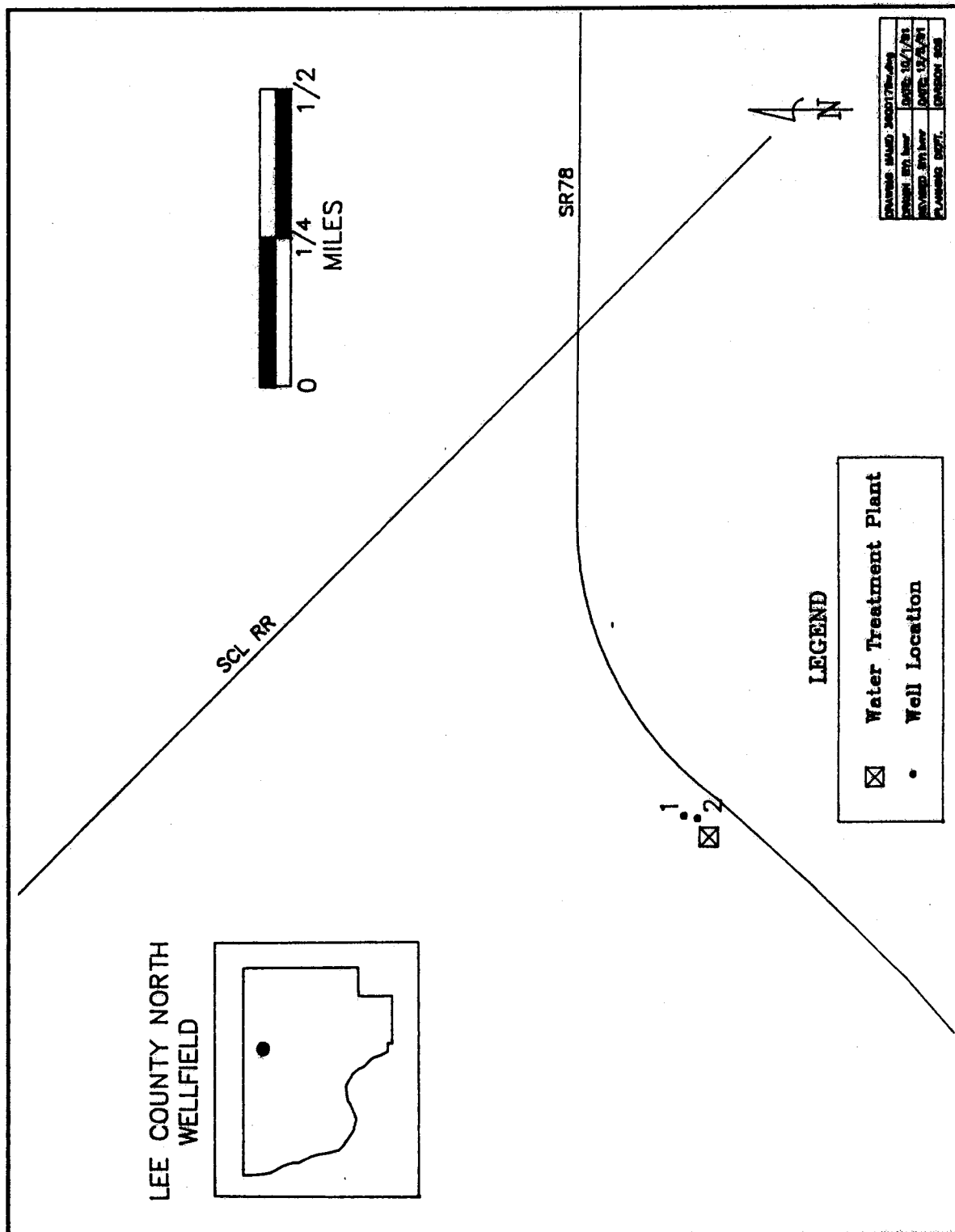


FIGURE E-23. Lee County North Fort Myers Emergency Facility Potable Water Supply Wells.

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Lee County Utilities Olga

SFWMD Permit Number: 36-00003-W
FDER PWS ID: 5360170

Raw Water Supply:

Raw water is withdrawn from the Caloosahatchee River (C-43) via a river intake structure located approximately three-quarters of a mile east of the W.P. Franklin Lock and Dam.

The current SFWMD permit was issued January 7, 1982 and expired January 7, 1992. The approved allocations are:

Annual Allocation:	1.25 BGY (3.42 MGD)
Maximum Daily Allocation:	5.00 MGD

The service area is located in the Lee County reduced threshold area.

Treatment Method:

Treatment is provided by a 5 MGD (FDER rated capacity) lime softening treatment facility. This facility is located at 1450 Werner Drive, Alva (Figure E-24). The 1990 average daily flow was 3.32 MGD, and the maximum day flow was 5.16 MGD.

In addition to this facility, an emergency facility is located in North Fort Myers. The emergency facility consists of two supply wells and an aeration treatment process. The finished water from the emergency facility is blended with water from the Olga plant in a 2 million gallon storage tank. This facility is used only when the Olga water treatment plant cannot deliver sufficient water to the 2 million gallon reservoir. It has not been utilized in the past couple of years.

Interconnections:

This facility serves the northern portion of the Lee County service area, but is interconnected with the Lee County South service area and transfer of water between the two is on an as needed basis. The system (North and South) has eight interconnects, four with Fort Myers and four with Florida Cities Water Company. They are:

<u>Location</u>	<u>Size (inches)</u>
<u>City of Fort Myers</u>	
Armeda Avenue & Prospect Street	6
Collins Street & Evans Avenue	8
Colonial Boulevard & Metro Parkway Boulevard	10
Nuna Avenue and New York Avenue	6
<u>Florida Cities Waterway Estates (North System)</u>	
U.S. 41 & Pondella Road	6
Pondella Road & Betmar Boulevard	6
<u>Florida Cities South Fort Myers</u>	
U.S. 41 & Old Gladiolus Drive	6
McGregor Boulevard & Cypress Lake Drive	4

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Proposed:

An application to modify this permit is under review by the SFWMD. Lee County indicates that their 1998 annual potable water demand is expected to increase to 13.37 MGD. The demand is expected to be satisfied by 3.42 MGD from the Olga water treatment plant and 9.95 MGD from the Corkscrew water treatment plant. Maximum month and maximum day demands are expected to be 15.24 and 19.36 MGD, respectively. The current allocation is being requested for the Olga facility.

The county is also planning to construct a second river crossing to serve the North Fort Myers area. The pipeline will be attached to the Edison River Bridge, which is under construction. The primary source of water for this pipeline will be the Corkscrew facility.

Future:

The Department of Lee County Utilities' 20-Year Master Plan, dated November 1991, indicates that the Olga treatment plant will remain 5 MGD. The county is investigating the feasibility of constructing an artificial aquifer recharge system and wellfield in the Lehigh Acres area which would utilize water from the Caloosahatchee River. The utility believes that the proposed wellfield would be a more reliable source of water during drought periods.

Source:

Information was obtained from the Department of Lee County Utilities and SFWMD water use permit files.

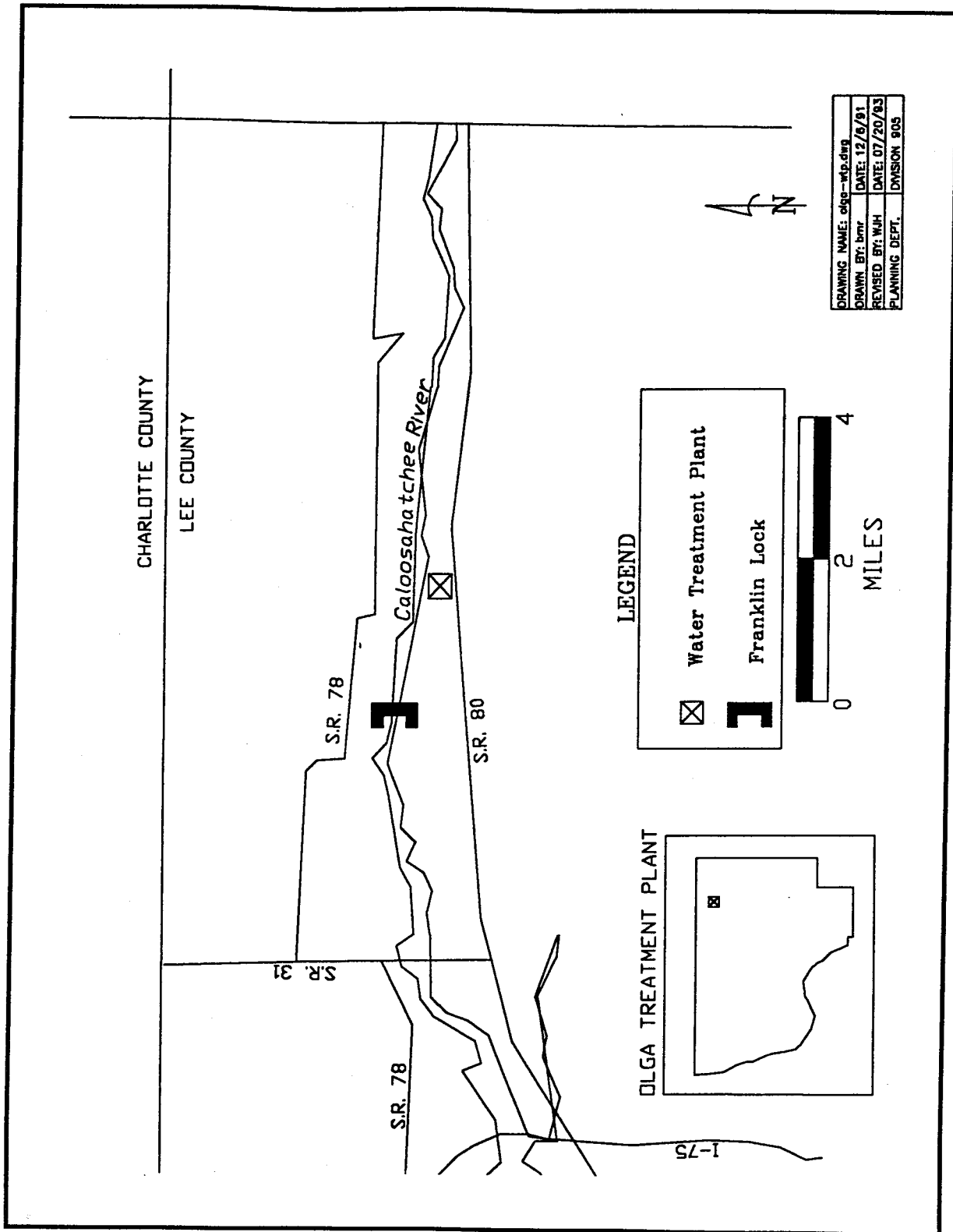


FIGURE E-24. Lee County Olga Water Treatment Plant.

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Lehigh Utilities

SFWMD Permit Number: 36-00166-W
FDER PWS ID: 5360172

Raw Water Supply:

Raw water is withdrawn from 10 wells located in the Lehigh Utilities service area. The wells, which were drilled between 1955 and 1989, withdraw water from the sandstone aquifer, are 6 and 8 inches in diameter, have total depths between 62 and 85 feet, and cased depths between 50 and 63 feet. The withdrawal capacities are between 100 and 350 GPM. Specific well information is provided in Table E-26 and the location of the wells can be found in Figure E-25.

The current SFWMD permit was issued June 13, 1991 and expires June 13, 1996. The approved allocations are:

Annual Allocation:	759.00 MGY (2.08 MGD)
Maximum Daily Allocation:	2.74 MGD

The 1990 average daily withdrawal was 1.28 MGD, with a maximum day withdrawal of 1.81 MGD.

The service area is located in the Lee County reduced threshold area.

Treatment Method:

Treatment is provided by a 2.50 MGD (FDER rated capacity) lime softening treatment facility. This facility is located at 305 Coolidge Avenue, Lehigh Acres (Figure E-25). The 1990 average daily flow was 1.23 MGD, and the maximum day flow was 1.55 MGD.

Interconnections:

There are no interconnections with other potable water distribution systems.

Proposed:

Development of a water supply master plan is anticipated to be completed this year.

Future:

It is estimated that the average daily demand will increase to 2.08 MGD, with a maximum day demand of 2.89 MGD by 1996.

Source:

Information was obtained from Lehigh Utilities, Inc, Southern States Utilities and SFWMD water use permit files.

TABLE E-26. Lehigh Utilities Potable Water Supply Wells.

Well Number	1	2	3	4	5	6	7	8	9	10
Planar Coordinates	292448 E 826739 N	291046 E 825234 N	289213 E 825043 N	290225 E 827102 N	290943 E 826578 N	289426 E 826282 N	292688 E 824835 N	290591 E 824057 N	289309 E 823634 N	291115 E 823841 N
Status	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Aquifer	Sand- stone	Sand- stone	Sand- stone	Sand- stone	Sand- stone	Sand- stone	Sand- stone	Sand- stone	Sand- stone	Sand- stone
Total Depth (ft)	65	69	68	85	66	62	85	80	80	80
Cased Depth (ft)	50	52	58	50	54	52	57	62	63	60
Well Diameter (in)	6	6	8	8	8	8	8	8	8	8
Pump Capacity (gpm)	150	150	200	150	150	100	200	250	200	350
Intake Depth (ft)	--	--	--	--	--	--	--	--	--	--
Year Drilled	1955	1962	1970	1970	1962	1970	1970	1970	1970	1989

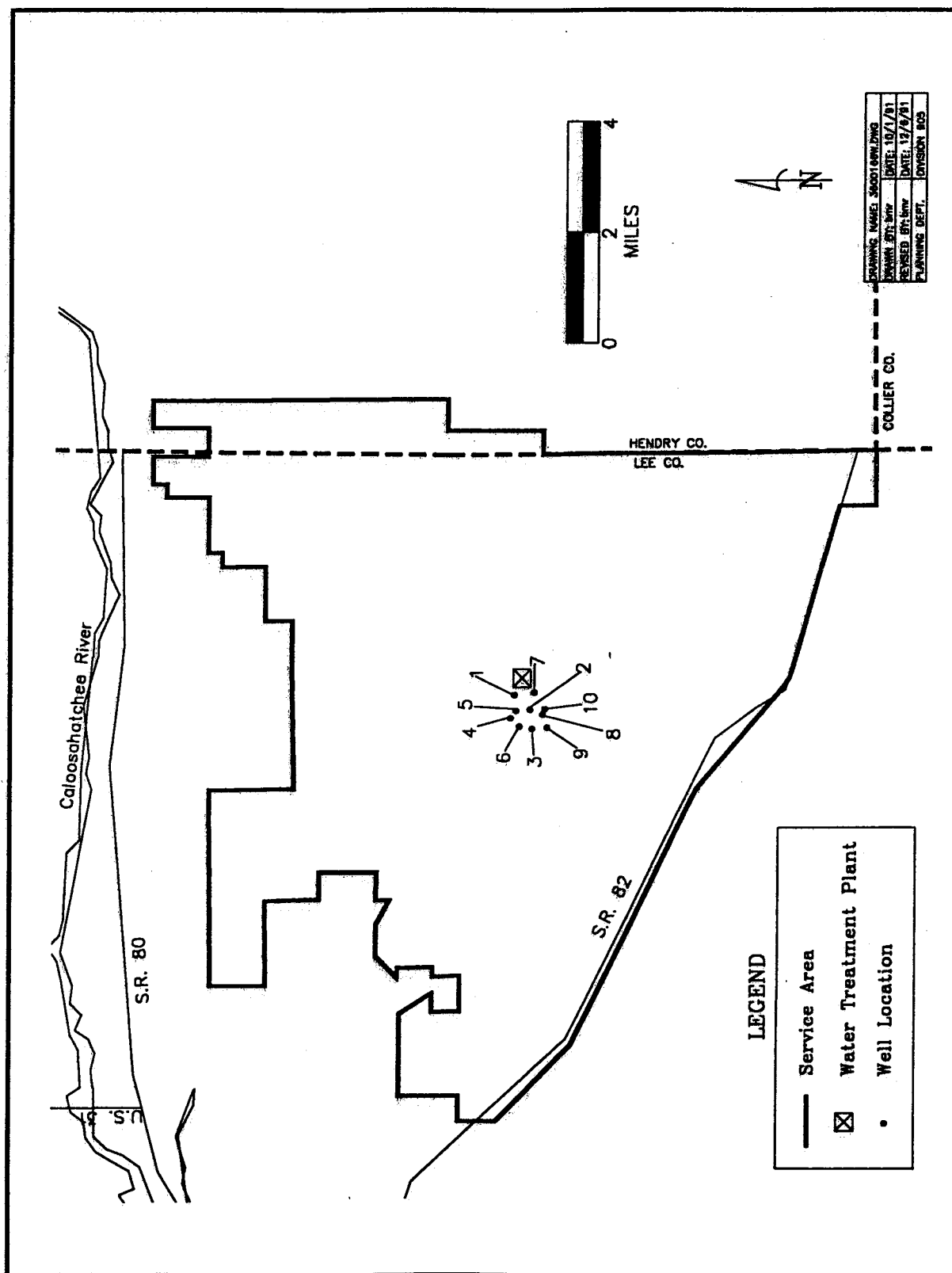


FIGURE E-25. Lehigh Utilities Potable Water Supply Wells.

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LOWER WEST COAST PLANNING AREA

WASTEWATER TREATMENT FACILITIES

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WASTEWATER TREATMENT FACILITIES

The primary means of wastewater treatment in the Lower West Coast Planning Area is through wastewater treatment facilities and septic tanks. There are approximately 350 existing FDER regulated wastewater treatment facilities in the LWC Planning Area, 21 of which have a FDER rated capacity of 0.50 million gallons per day (MGD) or greater. This discussion focuses on these 21 facilities because they have sufficient flows that could have a positive impact on the water resource through reuse. These facilities are large enough to allow economy of operation in support of a regional reuse program. Many are also located in areas in close proximity to potential reclaimed water users.

These existing and future facilities are located in most of the urbanized areas throughout the LWC Planning Area, as indicated on Figure E-26. More than half of the facilities are municipally owned. All the facilities utilize the activated sludge treatment process. The reclaimed water/effluent disposal methods consist of discharge to surface waters, deep well injection, and reuse via green space irrigation and ground water recharge. These facilities have a total rated capacity of 85.74 MGD and are identified by facility name in Table E-27. The table lists the average daily flows (ADF) and the method of disposal in 1990 for each facility. The 1990 ADF for these facilities was 41.76 MGD.

The wastewater flows for these facilities are projected to increase to approximately 146.55 MGD by the year 2010. As regulatory criteria are becoming more stringent for surface water discharge, the utilities should start planning for effluent/reclaimed water disposal in an environmentally acceptable way. General descriptions of the disposal methods follow:

Disposal Methods

Surface Water Discharge

This method of effluent disposal consists of disposing the effluent through a pipeline to a receiving surface water. Effluent prior to disposal is required to have received at least secondary treatment (20 mg/L carbonaceous biochemical oxygen demand [CBOD], 20 mg/L total suspended solids [TSS] or 90 percent removal, whichever is more stringent) and basic level disinfection. Additional levels of treatment may be required and are based upon the characteristics of the effluent and the receiving water, as well as other regulatory requirements and standards. Effluent standards from this method are known as water quality based effluent limitations (WQBELs). A WQBEL is a means of determining the available assimilative capacity of a water body and setting effluent limits utilizing appropriate procedures for simulation and prediction of water quality impacts. WQBELs are established to ensure that water quality standards in a receiving body of water will not be violated (Chapter 17-650, F.A.C.).

As regulatory requirements become more stringent, many of the dischargers may choose to find an alternative means for effluent disposal. In addition, any new discharge or expansion of an existing discharge must justify compliance with the state's antidegradation requirements prior to issuance of a permit for such a discharge. The antidegradation rule requires a utility proposing to construct a new discharge, or expanding an existing discharge, to demonstrate that an alternate

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disposal method such as reuse of domestic reclaimed water is not feasible in lieu of a discharge to surface water, and that such a discharge is clearly in the public interest. A summary of the state's antidegradation rule is provided in Figure E-27.

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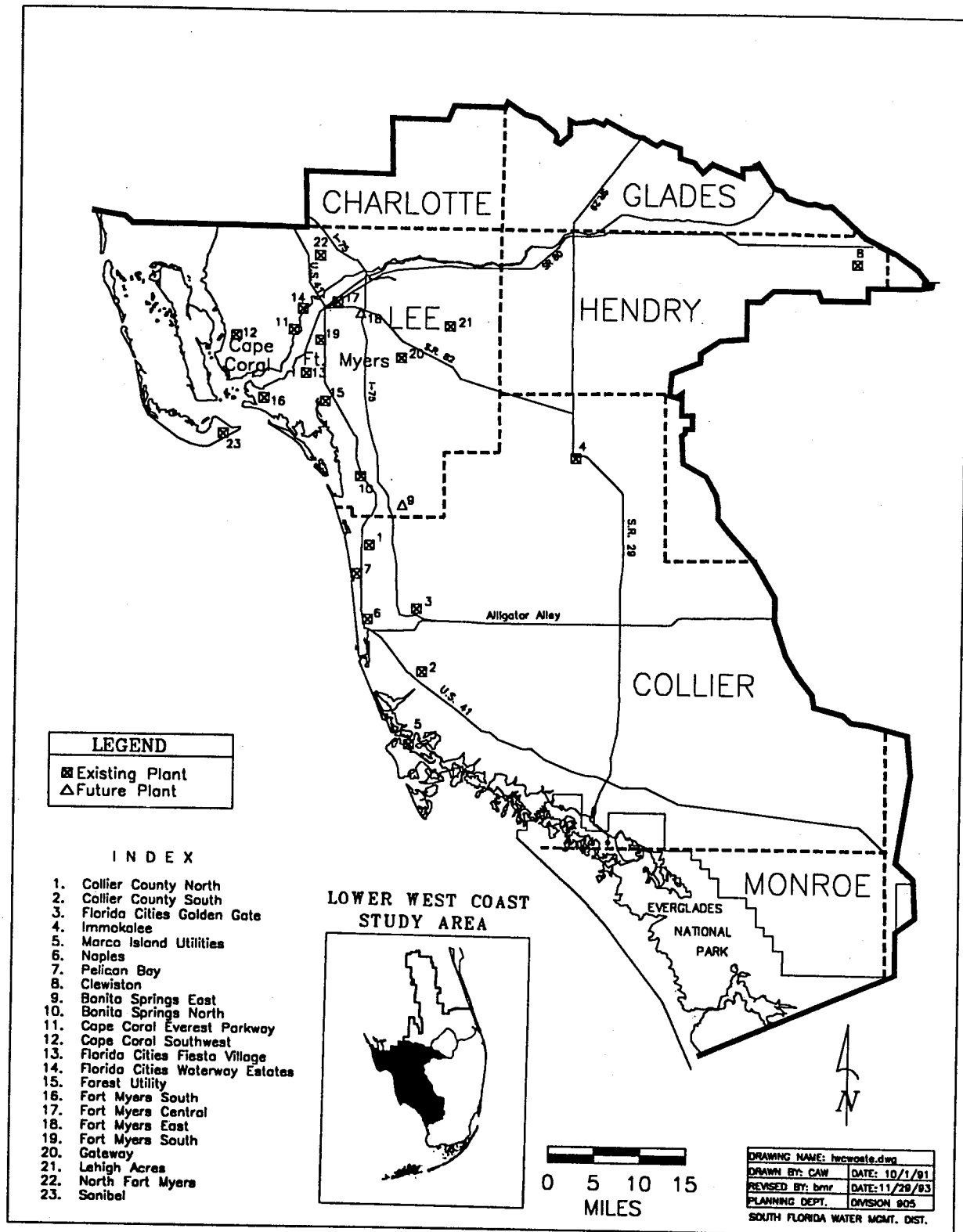


FIGURE E-26. Wastewater Treatment Facilities in the LWC Planning Area.

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TABLE E-27. LWC Planning Area Wastewater Treatment Facilities (≥ 0.50 MGD).

Facility	FDER Rated Capacity (MGD)	1990 Average Daily Flow (MGD)	1990 Disposal Method			Chloride Concentration (mg/L)	Year 2010 Projected Flow (MGD)
			Deep Well Injection (MGD)	Surface Water (MGD)	Reuse (MGD)		
Collier County	4.50	2.20			2.20	265	11.43
Collier County North	8.00	2.31			2.31	c	17.92
Collier County South	0.75	0.67			0.67	c	0.88
FL Cities Golden Gate	2.50	1.58			1.58	c	2.23
Immokalee	3.50	2.30			2.30	252	4.15
Marco Island	8.50	5.49		2.33	3.16	263	7.30
Naples	1.00	0.80			0.80	c	a
Pelican Bay			0.00	2.33	13.02		43.91
County Subtotal	28.75	15.35					
Hendry County	1.16	0.79			0.79	c	1.23
Clewiston	1.16	0.79	0.00	0.00	0.79		1.23
County Subtotal							
Lee County	2.40	0.07			0.07	c	6.27
Bonita Springs West	b	b				c	e
Bonita Springs East	7.30	6.27		6.27		300-700	11.90
Cape Coral Everest	7.00	d			0.60	c	5.50
Cape Coral Southwest	2.50	1.71		1.11		211	2.00
FL Cities Fiesta Villages	1.00	0.82		0.82		245	1.36
FL Cities Waterway Estates	0.50	0.30			0.30	c	0.70
Forest Utilities	6.00	2.43			2.43	241	5.63
Fort Myers Beach	11.00	6.21		6.21		244	11.00
Fort Myers Central	b	b				c	10.00
Fort Myers East	12.00	5.86		5.86		170	24.00
Fort Myers South	1.00	0.01			0.01	c	5.50
Gateway	1.88	1.17			1.17	c	4.55
Lehigh Utilities	2.00	0.21	0.08		0.13	207	11.45
North Fort Myers	1.25	0.56			0.56	c	1.55
Sanibel			0.08				
County Subtotal	55.83	25.62	0.08	20.27	5.27		101.41
Lower West Coast Total	85.74	41.76	0.08	22.60	19.08		146.55

a- Facility 2010 projection incorporated into Collier County North.

b- Proposed/future facility.

c- Chloride concentration not available.

d- Initiated operation after 1990.

e- Facility 2010 projection incorporated into Bonita Springs West.

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Florida's Antidegradation Standards

In reviewing a permit application for a surface water discharge, the Florida Department of Environmental Regulation must assure the application is consistent with the antidegradation policy set forth in Section 17-3.041, Florida Administrative Code (F.A.C.) prior to issuance of a permit. Such that, when reviewing a permit application for a surface water discharge, the following criteria must be reviewed:

1. Whether water quality standards will be violated.
2. Whether "existing uses" are being maintained.
3. Whether the proposed (new or expanded) discharge is "necessary or desirable under federal standards and under circumstances which are clearly in the public interest."

This requires consideration of:

a. The balancing test

The benefit to the public health, safety, and welfare is to be balanced against whether the discharge will adversely affect fish and wildlife, endangered species, or their habitats; whether the proposed discharge will adversely affect recreation or marine resources; and whether the proposed discharge is consistent with any applicable SWIM plan.

b. The options review

This requires the applicant to demonstrate that neither of the following is economically and technologically reasonable:

- 1) Reuse of domestic reclaimed water.
- 2) Certain other options other than the proposed discharge that would eliminate or minimize the need to lower water quality (those others being reuse, use of other discharge locations, or land application).

FIGURE E-27. Surface Water Discharge Antidegradation Standards.

In addition, Lee County has adopted an ordinance (number 90-53) which addresses the regulation of wastewater discharges into surface waters of Lee County. It provides for the conservation of the county's water resources by mandating reuse of treated wastewater. The ordinance states that all wastewater discharges into surface waters of the county shall do so only pursuant to the specific terms and conditions of a Lee County wastewater discharge permit. It is the purpose and intent of Lee County to provide for discharges of treated wastewater only as an alternate or emergency method of disposal to a reuse system. The ordinance contains a municipal option, that excludes all areas within incorporated limits of any municipality from the provisions of this ordinance upon formal prior notification by resolution to Lee County that the municipality is exercising such option prior to January 1, 1991. The ordinance became effective on October 26, 1990. All municipalities exercised the municipal option. Therefore, this ordinance impacts the two Florida Cities wastewater treatment facilities.

In Lee County, five facilities utilize discharge to the Caloosahatchee River for effluent disposal, while one facility in Collier County discharges a portion of its effluent to the Gordon River. All these facilities provide, or are in the process of providing, advanced wastewater treatment which results in the reduction of nutrients in the effluent. Effluent disposal via discharge to surface waters accounted for 54 percent (22.60 MGD) of effluent disposal in the LWC Planning Area in 1990.

A WQBEL determination was conducted by FDER on the stretch of the Caloosahatchee River between Beautiful Island and Shell Point (Baker, 1990). This

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section of the river has five major treated wastewater point source dischargers: (1) the City of Cape Coral, (2) the City of Fort Myers South, (3) the City of Fort Myers Central, (4) Florida Cities Fiesta Village, and (5) the Florida Cities Waterway Estates wastewater treatment facilities. At the time of the report, the rated capacities of these facilities were 7.3 MGD, 12 MGD, 11 MGD, 5 MGD and 1.08 MGD, respectively. The WQBEL was conducted to determine the impact of the proposed increases in discharge from these facilities on the river's water quality. Computer modeling indicated that, with the discharge at the current effluent quality and the relocation of two points of discharge (City of Cape Coral and Florida Cities Waterway Estates), the proposed increases will not contribute to violations of Class III water quality standards. The increases will utilize the entire reserve capacity of the system. The five facility capacities that were modeled were 14.6 MGD, 13 MGD, 11 MGD, 5 MGD and 1.5 MGD, respectively.

Deep Well Injection Class I Wells

This method of disposal consists of injecting secondary treated (20 mg/L CBOD, 20 mg/L TSS) effluent (no disinfection required) through a steel conduit (casing) to the "boulder zone," a fractured cavernous carbonate sequence formation found at depths ranging from 3000-3300 feet below the ground surface in the LWC Planning Area. There is one existing facility, North Fort Myers, which utilizes deep well injection for a portion of its effluent disposal. It also serves as an alternative means of disposal for the reuse system. Disposal by deep well injection accounted for only 0.2 percent (0.08 MGD) of the effluent disposal in 1990. Marco Island Utilities recently completed a deep well injection system for concentrate disposal for their reverse osmosis water treatment facility. The deep well will also serve as a backup disposal method to their reuse system.

Reuse

This method of disposal consists of utilizing treated wastewater (reclaimed water) for a beneficial purpose. Various methods of reuse are identified in the reuse section of this report. There are 16 facilities in the LWC Planning Area that reused all or a portion of their 1990 flows. In 1990, reclaimed water was utilized for golf course, residential lawn, park and green space irrigation, and for ground water recharge via percolation ponds. Many of the facilities utilize their reclaimed water/effluent for plant process water, and some for irrigation of the utility site (which also could be considered reuse). In 1990, 46 percent (19.08 MGD) of the treated wastewater was reused. Over 27 golf courses in the planning area utilized reclaimed water for irrigation in 1990.

Effluent disposal via discharge to surface waters and deep well injection result in net loss from the water supply inventory. These methods of effluent disposal accounted for 22.68 MGD of water lost from the water supply inventory. Most of the facilities utilizing these methods of effluent disposal could have potentially made reclaimed water available for reuse with the addition of filtration and associated chemical feed facilities, disinfection, and reclaimed water monitoring equipment at the treatment plant. The facilities would have to justify a facility reliability of Class I, or an equivalent, which may exist via their existing method of disposal. The existing method of effluent disposal may also be viable as an alternative means of disposal, which may negate the need for regulatory mandated system storage. Additional information on reuse can be found in the wastewater reuse discussion in Chapter V and Appendix I.

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Summary Descriptions of Existing Wastewater Facilities

Summary descriptions for each of the wastewater treatment facilities in the LWC Planning Area, from which the previously summarized information was obtained, are presented in the following section. Each utility capsule contains the following information:

Treatment/Disposal - This section states the current FDER rated capacity, method of treatment and disposal, the 1990 average daily flow, and the reclaimed water/effluent chloride concentration.

Address - This section provides the treatment plant address or location.

Reuse Feasibility - This section states what would be generally required for the treatment facility to produce reclaimed water for public access irrigation and any known constraints.

Proposed - This section states any current construction or permitting that is occurring.

Future - This section provides the projected flows and known future treatment plant expansions and plans, including new additional facilities.

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COLLIER COUNTY

WASTEWATER TREATMENT FACILITIES

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Collier County North

Treatment/Disposal:

There is an existing 4.50 MGD activated sludge (contact stabilization and oxidation ditch) wastewater treatment plant with reclaimed water disposal by reuse via golf course irrigation and ground water recharge via 50 acres of percolation ponds. Irrigation with reclaimed water has been implemented on the following golf courses:

Site

Imperial G. C.
Audubon G.C.
Palm River G.C.
Collier Reserve G.C.

Reclaimed water in excess of these demands are delivered to Pelican Bay for reuse.

The 1990 average daily flow was 2.20 MGD. The typical average reclaimed water chloride concentration is 265 mg/L.

Location:

State Road 846 and Coastline Railroad, Naples.

Reuse Feasibility:

This facility currently produces reclaimed water for public access green space spray irrigation and for ground water recharge via percolation ponds. This facility is designed to provide reclaimed water for public access irrigation at its design capacity.

Proposed:

A 3.00 MGD expansion is under construction. Reuse will be the method of disposal.

Future:

The utility master plan projects the average daily wastewater flows will increase to 11.43 MGD by 2010. This facility is anticipated to be expanded by an additional 3 MGD in 1995, 1998, and 2003, for a total treatment plant capacity of 12.50 MGD which will be sufficient through 2010. Future reclaimed water disposal is proposed to be reuse. The ultimate build-out wastewater generation for the service area is projected to be 32.24 MGD.

Source:

Information provided by Collier County Utilities.

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Collier County South

Treatment/Disposal:

There is an existing 8 MGD activated sludge (oxidation ditch) wastewater treatment plant with reclaimed water disposal by reuse via golf course irrigation and ground water recharge via 50 acres of percolation ponds. This facility was placed into operation in early 1991 and replaced three subregional facilities. This facility provides reclaimed water for spray irrigation to the following golf courses:

<u>Site</u>	
Foxfire G.C.	Windstar G.C.
Glades G.C.	Countryside G.C.
Turtle Cove G.C.	Riviera G.C.
Lely Royal Palm G.C.	

The 1990 total average daily flow of the three subregional facilities was 2.31 MGD.

Location:

5600 Warren Street, Naples.

Reuse Feasibility:

This facility currently produces reclaimed water for public access spray irrigation via golf course irrigation and ground water recharge via percolation ponds. This facility is designed to provide reclaimed water for public access irrigation at its design capacity.

Proposed:

The following golf courses plan to implement irrigation with reclaimed water in the future:

<u>Site</u>	<u>Type</u>	<u>Estimated Irrigation Demand (MGD)</u>
Lely Hibiscus G.C.	Golf Course	0.50
Lakewood G.C.	Golf Course	0.41
Lely Resort	Golf Course & Residential	--

Future:

The utility master plan projects the average daily wastewater flows will increase to 17.92 MGD by 2010. Future reclaimed water disposal is proposed to be reuse. The ultimate build-out wastewater generation for the service area is projected to be 37.50 MGD.

Source:

Information provided by Collier County Utilities.

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Florida Cities Golden Gate

Treatment/Disposal:

There is an existing 0.75 MGD activated sludge (contact stabilization) wastewater treatment plant with reclaimed water disposal by reuse via ground water recharge by percolation ponds. The 1990 average daily wastewater flow was 0.67 MGD.

Location:

4931 32nd Avenue Southwest, Golden Gate.

Reuse Feasibility:

This facility is currently reusing reclaimed water for ground water recharge via percolation ponds. The facility is providing secondary treatment with basic level disinfection. If public access spray irrigation is pursued, filtration and an associated chemical feed system, disinfection facilities and reclaimed water monitoring equipment would have to be constructed pursuant to Chapter 17-610, F.A.C. In addition, Class I reliability or an equivalent will have to be provided. This may exist via the existing method of reclaimed water disposal.

Proposed:

A 0.50 MGD expansion is under design. The method of disposal will be percolation ponds. Construction of this facility is anticipated to be completed by spring of 1994.

Future:

No flow projections or future facility plans are available. Based on SFWMD potable water flow projections and a 78 percent return factor in 1990, the 2010 wastewater flows are estimated to be 0.88 MGD.

Source:

Information provided by Florida Cities Water Company.

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Immokalee

Treatment/Disposal:

There is an existing 2.50 MGD activated sludge (oxidation ditch) wastewater treatment plant with reclaimed water disposal by reuse via restricted public access spray irrigation on approximately 190 acres of hay fields. The 1990 average daily flow was 1.58 MGD.

Location:

1020 Sanitation Road, Immokalee.

Reuse Feasibility:

The existing and expanded proposed method of reclaimed water disposal is reuse pursuant to Chapter 17-610, F.A.C. The facility is providing secondary treatment with basic level disinfection. If public access spray irrigation is pursued, filtration and an associated chemical feed system, disinfection facilities and reclaimed water monitoring equipment would have to be constructed pursuant to Chapter 17-610. In addition, Class I reliability or an equivalent will have to be provided. This may exist via the existing method of reclaimed water disposal.

Proposed:

Increase the sprayfields to the permitted 364 irrigated acres of a total 550 acre site.

Future:

Flow projections estimates average daily flows will increase to 2.23 MGD by 2010 with a maximum month average daily flow of 2.61 MGD.

Source:

Information was provided by the Immokalee Water-Sewer District and their engineers.

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Marco Island

Treatment/Disposal:

There is an existing 3.50 MGD activated sludge (contact stabilization) wastewater treatment plant with reclaimed water disposal by reuse via golf course irrigation and ground water recharge via 34.6 acres of percolation ponds. Irrigation with reclaimed water is implemented at the following locations:

<u>Site</u>	<u>Type</u>	<u>1990 ADF (MGD)</u>
Marco Island G.C.	Golf Course	0.16
Marco Shores G.C.	Golf Course	0.23

The deep well injection system constructed for concentrate disposal for the recently completed reverse osmosis water treatment facility will serve as a backup disposal to the reuse program.

The 1990 average daily flow was 2.30 MGD. The typical average reclaimed water chloride concentration is 252 mg/L.

Location:

100 Winward Drive, Marco Island.

Reuse Feasibility:

This facility currently produces reclaimed water for public access spray irrigation on two golf courses and ground water recharge via percolation ponds.

Proposed:

N/A

Future:

The existing facility is anticipated to have sufficient capacity through 1995, at which time a 0.75 MGD expansion is projected. The expanded capacity will be adequate through 2001, at which time an additional 1.75 MGD expansion is planned. These expansions will utilize deep well injection for effluent disposal. The 2010 projected average daily wastewater flow is 4.15 MGD. The 2010 maximum monthly daily flow is 5.21 MGD. Since the service area is seasonal, the additional treatment capacity is necessary.

Source:

Information provided by Southern States Utilities.

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Naples

Treatment/Disposal:

There is an existing 8.50 MGD activated sludge (conventional) wastewater treatment plant with reclaimed water/effluent disposal by golf course, park, right-of-way, and common area spray irrigation and discharge to the Gordon river. Irrigation with reclaimed water is implemented at the following locations:

Site	Type	1990 ADF (MGD)
Royal Poinciana	Golf Course	0.36
Wilderness Country Club	Golf Course	0.35
Bears Paw	Golf Course	0.24
Naples Beach Club	Golf Course	0.27
Country Club of Naples	Golf Course	0.26
Hole-in-the-Wall	Golf Course	0.24
Quail Run	Golf Course	0.15
Moorings Country Club	Golf Course	----
High Point Golf & Tennis	Golf Course	0.13
Moorings Park	Green Space	----
Fleishman Park	Green Space	----
Naplescape	Green Space	----

The 1990 average daily wastewater flow was 5.49 MGD. On an annual basis, approximately 60 percent of the wastewater flow is reused. The average chloride concentration is 263 mg/L.

Location:

1400 3rd Avenue North, off Goodlette Road, Naples.

Reuse Feasibility:

This facility is designed to produce 8.50 MGD of reclaimed water for public access irrigation. Additional users are being sought.

The City of Naples Comprehensive Code requires all new developments of 10 acres or more to connect to the reclaimed water system if it is available as a condition of connection to either the city's potable water or sewer system.

Proposed:

By the end of 1994, the City anticipates providing reclaimed water to the Commons, a 3.5 acre recreational area, at the Middle School and additional median strips. A wastewater and reclaimed water master plan are under development.

Future:

Flow projections estimates an average daily flow of 7.30 MGD in 1998. Additional users of reclaimed water are being sought.

Source:

Information supplied by the City of Naples.

Pelican Bay

Treatment/Disposal:

There is an existing 1.00 MGD activated sludge (extended aeration) wastewater treatment plant with reclaimed water disposal by golf course and landscape spray irrigation. The reclaimed water is discharged to on-site irrigation water holding facilities from which irrigation water is obtained for the development's irrigation system. The irrigation system radiates throughout the development for golf course, residential, and other green space irrigation. The 1990 average daily wastewater flow was 0.80 MGD.

Location:

Intersection of Pelican Bay Boulevard and Gulf Park Drive, Naples.

Reuse Feasibility:

This facility is currently producing reclaimed water for reuse via public access irrigation on golf course, residential, and other green space.

Proposed:

This facility will be taken out of service when the connection to the Collier County system occurs (within two years). Collier County Utilities will continue to deliver reclaimed water to Pelican Bay at a volume equal to or greater than their wastewater flows.

Future:

Collier County projects flows from this service area will increase to 2.19 MGD by 2010.

Source:

Information was obtained from SFWMD consumptive use permitting information, Collier County Comprehensive plan, and Collier County Utilities.

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HENDRY COUNTY

WASTEWATER TREATMENT FACILITIES

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Clewiston

Treatment/Disposal:

There is an existing 1.50 MGD activated sludge (oxidation ditch) wastewater treatment plant with reclaimed water disposal by reuse via restricted public access spray irrigation on 148 acres of grass fields used for hay cultivation. This facility is limited to 1.16 MGD due to the reclaimed water disposal capacity. The spray fields contain underdrains that discharge to a perimeter ditch; the perimeter ditch discharges to the Sugarland District canals and ultimately to the Caloosahatchee River. The 1990 average daily flow was 0.79 MGD.

Location:

Feed Lot Road, Clewiston.

Reuse Feasibility:

The existing and expanded proposed method of reclaimed water disposal is reuse pursuant to Chapter 17-610, F.A.C. The facility is providing secondary treatment with basic level disinfection. If public access spray irrigation is pursued, filtration and an associated chemical feed system, disinfection facilities and reclaimed water monitoring equipment would have to be constructed pursuant to Chapter 17-610. In addition, Class I reliability or an equivalent will have to be provided. This may exist via the existing method of reclaimed water disposal.

Proposed:

N/A

Future:

Projected average daily flows for the City of Clewiston for the year 2000 are 0.99 MGD. The existing facility is adequate provided additional disposal capacity is constructed. Flow projections, based on the average yearly flow increases from 1988 to 2000 in the city's comprehensive plan and projected to 2010, indicate that an average daily wastewater flow of 1.23 MGD in 2010 can be expected.

Source:

Information provided by the City of Clewiston.

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LEE COUNTY

WASTEWATER TREATMENT FACILITIES

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Bonita Springs Utilities

Treatment/Disposal:

There is an existing 2.40 MGD activated sludge wastewater treatment plant with reclaimed water disposal by reuse via public access spray irrigation of golf courses, residential properties and other green areas in the Bonita Bay area. The 1990 average daily wastewater flow was 0.07 MGD.

Location:

On new U.S. 41 and south of old U.S. 41.

Reuse Feasibility:

This facility is currently reusing reclaimed water for public access spray irrigation.

Proposed:

Continue to extend forcemains into areas that are served by package plants. Approximately 35 package plants have connected to the system.

Future:

The 1990 master plan has been developed to provide regionalized wastewater collection, treatment, and disposal to this area by the Bonita Springs Utilities in compliance with the Lee County Comprehensive Plan and the 201 Facilities Plan. Wastewater treatment and disposal in the Bonita Springs area is currently provided by approximately 70 package wastewater treatment plants. Areas not serviced by these package plants are served by on-site septic tanks.

The master plan consists of a two treatment plant approach in the BSWs franchised area. The plants are referred to as the Bonita Springs North (BSN) and Bonita Springs East (BSE) plants. The BSN described above is planned to have an ultimate capacity of 6.00 MGD, which will be achieved through two 2.00 MGD expansions.

The BSE would involve the construction of a 2.00 MGD plant located East of I-75 and North of Bonita Beach Road. This facility is proposed to have an ultimate capacity of 6.00 MGD, which will be achieved through two 2.00 MGD expansions. This facility is not scheduled to be constructed at the time of this writing.

Projected wastewater flows for the franchised area are anticipated to ultimately increase to 10.03 MGD seasonally and 6.27 annually. To accommodate these flows, 2.00 MGD expansions are proposed to be completed by 1997, 2001, 2005 and 2012 and will be based on need. Expansions are not differentiated between the two plants and only pertains to the treatment capacity of the system.

Reclaimed water disposal will be reuse via public access irrigation of golf courses, residential areas, and other green space. The initial 3.00 MGD of reclaimed water produced is contracted to Bonita Bay for golf course, lawn and other green area irrigation. Other potential users are:

<u>Site</u>	<u>Estimated Irrigation Demand (MGD)</u>
Parklands	0.60
Worthington	0.60
Hunters Ridge	0.60

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Spanish Wells	0.60
Bonita Springs Golf & CC	0.60
Spring Creek	1.58
Pelican's Nest	0.72
Ridgewood GC	0.36
Coconut Road GC	0.58

Source:

Information provided by the Bonita Springs Utilities.

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Cape Coral Everest

Treatment/Disposal:

There is an existing 7.30 MGD advanced wastewater treatment plant with effluent disposal by surface water discharge to the Caloosahatchee River via a 24-inch outfall. The 1990 average daily flow was 6.27 MGD. Effluent chloride concentrations are between 300 and 700 mg/L.

The City initiated operation of a system in early 1992 to provide reclaimed water for public access irrigation on residential lawns and other green space via a secondary water line as part of the Water Independence for Cape Coral program (WICC). As part of the WICC, reclaimed water and canal water is used as supply sources for the secondary system, which will be distributed throughout the city for residential lawn and other green space irrigation. Approximately 10,000 properties are connected to the system. The surface water discharge will serve as a backup to the secondary system. They will continue to connect additional users to the secondary system. A secondary water demand of 36.80 MGD is projected in 1993 and a 116 MGD at build-out.

The city is also constructing a wastewater collection system that will serve many of the areas that are currently served by septic tanks.

Location:

1800 Everest Parkway, Cape Coral.

Reuse Feasibility:

This facility currently provides irrigation on residential lawns and other green space in Cape Coral. Expanded wastewater flows will be reused in this manner.

Proposed:

An expansion of this facility to 14 MGD is under design. It is planned to begin construction in early 1994 with completion in 1996.

Future:

Projected wastewater flows for this facility estimate a year 2000 flow of 8.40 MGD, with a maximum month of 10 MGD, and a year 2009 flow of 11.90 MGD with a maximum month of 14.30 MGD.

Source:

Information provided by the City of Cape Coral.

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Cape Coral Southwest

Treatment/Disposal:

This facility, which initiated operation in the summer of 1993, consists of a 7.00 MGD advanced wastewater treatment plant with reclaimed water disposal via WICC secondary system (see Cape Coral Everest). This facility is connected to the surface water discharge outfall which will serve as backup to the WICC program.

This facility will serve the Cape Coral southwest service area.

Location:

This facility is located adjacent to the existing water treatment plant which is located at 3300 SW 20th Avenue, Cape Coral.

Reuse Feasibility:

This facility currently provides irrigation on residential lawns and other green space in Cape Coral. Expanded wastewater flow will be reused in this manner.

Proposed:

N/A

Future:

Projected wastewater flows for the year 2000 are 3.90 MGD with a maximum month of 4.60 MGD, and a year 2009 flow of 5.50 MGD with a maximum month of 6.60 MGD. This facility is anticipated to be expanded to 14 MGD in the future as the flows necessitate additional capacity.

Source:

Information provided by the City of Cape Coral.

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Florida Cities Fiesta Village

Treatment/Disposal:

This is an existing 2.50 MGD activated sludge advanced wastewater treatment plant with reclaimed water/effluent disposal by reuse via golf course irrigation and discharge to the Caloosahatchee River via a 24-inch outfall. Irrigation with reclaimed water is implemented at the following locations:

<u>Site</u>	<u>Type</u>	<u>1990 ADF (MGD)</u>
Cypress Lake	Golf Course	0.29
Myerlee	Golf Course	0.17
The Landings	Golf Course	0.28*

*Six month average - initiated reuse in July, 1990.

The 1990 average daily flow was approximately 1.71 MGD. The discharge to the river averaged 1.11 MGD for 1990. The typical average reclaimed water/effluent chloride concentration is 211 mg/L.

Unequipped structures are in place which will allow the plant's treatment capacity to be increased to 5.0 MGD.

Location:

1366 San Souci Drive, Fort Myers.

Reuse Feasibility:

This facility currently produces reclaimed water for public access spray irrigation on three golf courses with the excess effluent discharged to the Caloosahatchee River. This facility is designed to produce reclaimed water for public access irrigation at its design capacity.

A master plan for the potential reuse within this service area was developed in October, 1991. The plan identified potential reuse customers, reclaimed water demands and transmission piping. The plan divided the potential reuse program into two phases. Phase I will consist of serving several users along the outfall pipe which have a potential reclaimed water demand of approximately 0.20 MGD. Phase II potential customers include the Village of Seven Lakes and the Golf View Country Club golf courses and several other smaller uses which have a potential reclaimed water demand of approximately 1.14 MGD. A permit has been received for Phase I and implementation is underway. The utility is investigating potential options to implement Phase II of the program in addition to sufficient quantities of reclaimed water becoming available to support the phase.

Proposed:

Implementation of Phase I of the reuse plan.

Future:

No flow projections or future facility plans are available. Based on SFWMD potable water flow projections and a 73 percent return factor for this facility and the Fort Myers Beach wastewater facility in 1990, the 2010 wastewater flows are estimated to be 2.75 MGD.

Source:

Information provided by the Florida Cities Water Company.

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Florida Cities Waterway Estates

Treatment/Disposal:

There is an existing 1 MGD activated sludge advanced wastewater treatment plant with effluent disposal by surface water discharge to the Caloosahatchee River via an 18-inch outfall. The 1990 average daily flow was 0.82 MGD. The typical average effluent chloride concentration is 245 mg/L.

Location:

1667 Inlet Drive, North Fort Myers.

Reuse Feasibility:

This facility is designed to provide advanced wastewater treatment. For this facility to provide reclaimed water for public access spray irrigation in accordance with F.A.C. Chapter 17-610, filtration and associated chemical feed system, disinfection facilities and reclaimed water monitoring equipment would have to be constructed. Much of this equipment may exist as part of the existing treatment facility with the exception of the reclaimed water monitoring equipments. It is assumed that an equivalent to Class I reliability exists via the existing disposal method, which could also serve as an alternate means of disposal to the reuse system.

A master plan for the potential reuse within this service area was developed in October, 1991. The plan identified potential reuse customers, reclaimed water demands and transmission piping. Potential customers include the Lochmoor Country Club and El Rio golf courses and several other smaller uses which have a potential reclaimed water demand of approximately 0.70 MGD. The utility is investigating potential options to implement the program.

Proposed:

A 0.30 MGD expansion is under design for this facility. The proposed method of effluent disposal is surface water discharge.

Future:

No flow projections or future facility plans are available. Based on SFWMD potable water flow projections and a 91 percent return factor in 1990, the 2010 wastewater flows are estimated to be 1.44 MGD.

Source:

Information provided by the Florida Cities Water Company.

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Forest Utility

Treatment/Disposal:

An existing 0.50 MGD activated sludge (complete mix) wastewater treatment plant with reclaimed water disposal by reuse via golf course irrigation on the Forest Golf Course. The 1990 total plant average daily flow was 0.30 MGD.

Location:

Deer Run SW at Forest subdivision, Fort Myers.

Reuse Feasibility:

This facility currently produces reclaimed water for public access spray irrigation on the Forest Golf Course. This facility is designed to provide reclaimed water for public access irrigation at its design capacity.

Proposed:

N/A

Future:

The franchise area is projected to have a build-out wastewater flow of 0.70 MGD. There are no immediate plans for expansion at this time.

Source:

Information provided by Forest Utilities.

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Fort Myers Beach

Treatment/Disposal:

There is an existing 6 MGD activated sludge (conventional) wastewater treatment plant with reclaimed water disposal by reuse via golf course, residential, and green space irrigation and ground water recharge via percolation ponds. Irrigation with reclaimed water is implemented at the following locations:

<u>Site</u>	<u>Type</u>	<u>1990 ADF (MGD)</u>
Rivers Edge	Golf Course	0.52
Kelly Greens	Golf Course	0.19
Shell Point	Green Space	0.09
Health Park	Green Space	0.20
Bayside Estates	Green Space	0.10
McGregor Park	Green Space	0.01
Davis Court	Green Space	0.005

The 1990 average daily wastewater flow was approximately 2.43 MGD. The typical average reclaimed water chloride concentration is 241 mg/L.

Location:

17155 Pine Ridge Road, Fort Myers.

Reuse Feasibility:

This facility currently produces reclaimed water for public access spray irrigation on two golf courses, for residential and green space irrigation at six developments, and ground water recharge via the county's percolation ponds. Additional reuse sites will come online when development increases and there is sufficient reclaimed water available.

Proposed:

Seeking additional reclaimed water users.

Future:

The existing facility is anticipated to have sufficient capacity through 1998, at which time a 1.50 MGD expansion is projected. The expanded capacity will be sufficient at least through 2005. Annual average daily wastewater flow is projected to increase to 4.86 MGD with an average maximum month daily flow of 7.10 MGD by 2005. Utilizing a 3 percent increase annually, the 2010 average daily flow will increase to 5.63 MGD by 2010.

Source:

Information provided by Department of Lee County Utilities.

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Fort Myers Central

Treatment/Disposal:

There is an existing 11 MGD activated sludge advanced wastewater treatment plant with effluent disposal by surface water discharge to the Caloosahatchee River via a 36-inch outfall pipe. The 1990 average daily flow was 6.21 MGD. The average effluent chloride concentration is 244 mg/L.

Location:

1501 Raleigh Street, Fort Myers.

Reuse Feasibility:

This facility is designed to provide advanced wastewater treatment. For this facility to provide reclaimed water for public access spray irrigation in accordance with Chapter 17-610, F.A.C., filtration and associated chemical feed system, disinfection facilities and reclaimed water monitoring equipment would have to be constructed. In addition, Class I reliability or an equivalent will have to be justified. This may exist via the existing effluent disposal method. The City of Fort Myers developed a Reclaimed Water Master Plan. This 1992 document is intended to provide long range guidance to the City on developing and implementing its reclaimed water system. The plan is designed to achieve certain goals with associated resulting benefits in the areas of water resource management, environmental impacts, beautification and economic impacts. The plan identified a potential reclaimed water demand within the entire Fort Myers service area of 16.8 MGD during wet weather and 28 MGD during dry weather. Potential uses include cooling water at the resource recovery facility and irrigation of golf courses, residential lawns, nurseries, parks, schools and other green space. The implementation plan is broken down into phases with Phase I requiring three to five years.

The City of Fort Myers requires all new developments of 10 acres or greater to install a dual water distribution system with the anticipation of reclaimed water being made available in the future.

A 2.0 MGD reuse facility is being designed. Initial use includes 1.0 MGD for cooling water at the resource recovery facility, irrigation water for the City nursery, the Fort Myers cemetery, and ballfields, and additional users of the remainder are being sought.

Proposed:

N/A

Future:

The build-out average daily wastewater flow (ADF) from the Fort Myers service area, which includes a portion of unincorporated Lee County, is projected to be 44.40 MGD and is anticipated to be reached in 2007. It is projected that the 2007 ADF from the Central system service area will be 20.90 MGD, and 23.50 MGD from the South service area. This site is very limited and expansion of this facility is questionable. It is stated that a 6 MGD expansion may be able to be accomplished; however, it is more likely that additional flows will be diverted to the South system, or a new eastern wastewater treatment facility will be constructed.

Source:

Information provided by the City of Fort Myers.

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Fort Myers South

Treatment/Disposal:

There is an existing 12 MGD activated sludge advanced wastewater treatment plant with effluent disposal by surface water discharge to the Caloosahatchee River via a 42-inch outfall pipe. The 1990 average daily flow was 5.86 MGD. The average effluent chloride concentration is 170 mg/L.

Location:

1618 South Drive (Bowling Green Boulevard), Fort Myers.

Reuse Feasibility:

This facility is designed to provide advanced wastewater treatment. For this facility to provide reclaimed water for public access spray irrigation in accordance with Chapter 17-610, F.A.C., filtration and associated chemical feed system, disinfection facilities and reclaimed water monitoring equipment would have to be constructed. In addition, Class I reliability or an equivalent will have to be justified. This may exist via the existing effluent disposal method. The City of Fort Myers developed a Reclaimed Water Master Plan. This 1992 document is intended to provide long range guidance to the City on developing and implementing its reclaimed water system. The plan is designed to achieve certain goals with associated resulting benefits in the areas of water resource management, environmental impacts, beautification and economic impacts. The plan identified a potential reclaimed water demand within the entire Fort Myers service area of 16.8 MGD during wet weather and 28 MGD during dry weather. Potential uses include cooling water at the resource recovery facility and irrigation of golf courses, residential lawns, nurseries, parks, schools and other green space. The implementation plan is broken down into phases with Phase I requiring three to five years.

The City of Fort Myers requires all new developments greater than 10 acres to install a dual water distribution system with the anticipation of reclaimed water being made available in the future.

Proposed:

N/A

Future:

The 1988 sanitary sewer system master plan update indicates the build-out average daily wastewater flow (ADF) from the Fort Myers service area, which includes a portion of unincorporated Lee County, to be 44.40 MGD and is anticipated to be reached in 2007. It is projected the 2007 ADF from the South system service area will be 23.50 MGD and 20.90 MGD from the Central system service area. When needed, it is proposed to expand this facility to its ultimate capacity of 24.00 MGD. This expanded capacity is anticipated to be utilized by year 2001. To treat the projected 2007 beyond 24.00 MGD, it is proposed to construct an Eastern facility which will have an ultimate capacity of 10 MGD with no expansion to the Central facility. A possible location for an Eastern facility is at a city-owned site on the east side of Ortiz Road, south of and including the former Red Cross Center.

Source:

Information provided by the City of Fort Myers.

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Gateway Utility

Treatment/Disposal:

There is an existing 1.00 MGD activated sludge (contact stabilization) wastewater treatment plant with reclaimed water disposal via public access spray irrigation of the development's common areas and residences. The 1990 average daily flow was 0.01 MGD.

Location:

13240 Commerce Lakes Drive, Fort Myers.

Reuse Feasibility:

This facility is designed to reuse via public access spray irrigation all reclaimed water generated from this facility via irrigation of the development's residential lots, rights-of-way, park, schools, and common areas. One existing golf course and two proposed golf courses will use well water for irrigation as a result of insufficient quantities of reclaimed water. A dual water system is planned for the entire development.

Proposed:

N/A

Future:

The development that is served by this facility is estimated to be built-out in 40 years with an ultimate projected wastewater flow of 6.50 MGD. The existing facility is expected to be sufficient for the first 7 years of development. Future expansions of 1 MGD, 2 MGD and 2.50 MGD with a deep well being constructed as back-up to spray irrigation, are proposed to meet future demands. At build-out, it is expected that an additional 5.70 MGD of irrigation water beyond the 6.50 MGD of reclaimed water will be needed to meet the irrigation demands of the development.

Source:

Information supplied by Gateway Utilities.

Lower West Coast Water Supply Plan -- Appendix E

Lehigh Utilities

Treatment/Disposal:

There is an existing 2.48 MGD activated sludge (contact stabilization) wastewater treatment plant limited to 1.88 MGD because of reclaimed water disposal with reclaimed water disposal by reuse via golf course spray irrigation and ground water recharge by percolation ponds (13 acres). Irrigation with reclaimed water has been initiated on the Admiral Lehigh Golf Course (North). It is anticipated the golf course will use an average of 0.40 MGD of reclaimed water. The 1990 average daily wastewater flow was 1.17 MGD.

Location:

End of Construction Road, Lehigh Acres.

Reuse Feasibility:

This facility is currently reusing reclaimed water for golf course irrigation on the Admiral Lehigh Acres Course (North) and for ground water recharge via percolation ponds. Reuse is the proposed disposal method for future flows, via public access irrigation and percolation ponds.

Proposed:

N/A.

Future:

The 1993 master plan for this facility projects a 2010 average daily wastewater flow of 4.55 MGD with reuse as the preferred disposal method. The plan also anticipates the construction of three other treatment facilities within the service area.

Source:

Information provided by Lehigh Utilities, Inc.

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North Fort Myers

Treatment/Disposal:

There is an existing 2 MGD activated sludge (oxidation ditch) wastewater treatment plant with reclaimed water/effluent disposal by golf course spray irrigation and deep well injection. Irrigation with reclaimed water has been initiated on the Riverbend and Six Lakes Golf Course and at the Sabal Springs development. The 1990 average daily flow was 0.21 MGD, of which 0.13 MGD was reused. The average reclaimed water/effluent chloride concentration is 207 mg/L.

Location:

West of Jolson Road, north of Tucker Lane, Suncoast Estates in Lee County.

Reuse Feasibility:

This facility is currently producing reclaimed water for public access spray irrigation at various sites. It is the utility's intention to maximize reuse as additional sites become available.

Proposed:

This facility serves an area that is currently served by 35 "package" plants, 16 community septic tanks and 10,000 private septic tanks which are proposed to be abandoned when regional wastewater collection becomes available.

Future:

This facility's service area is estimated to have a 2010 wastewater flow of 11.45 MGD. Plant expansions are conceptually to be accomplished by a two phase expansion to 10 MGD consisting of two separate 4 MGD expansions. The first expansion is to be completed by 1995 and second by 2000. Reclaimed water/effluent disposal will be by reuse via spray irrigation on golf courses and by deep well injection.

Source:

Information supplied by Post, Buckley, Schuh & Jernigan for North Fort Myers Utilities.

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Sanibel Island

Treatment/Disposal:

There is an existing 1.25 MGD activated sludge (contact stabilization) wastewater treatment plant with reclaimed water disposal by reuse via golf course spray irrigation and percolation ponds. Reclaimed water is utilized for irrigation on the Beachview and Dunes Golf Club golf courses. The 1990 average daily flow was 0.56 MGD.

Location:

930 Donax Street, Sanibel.

Reuse Feasibility:

This facility is currently producing reclaimed water for golf course irrigation at the Beachview and Dunes Golf Club golf courses. It is stated that these golf courses have disposal capacity's of 0.98 MGD and 1.27 MGD, respectively which exceeds the capacity of the plant.

Proposed:

This facility is being expanded to 1.60 MGD. Construction is anticipated to be complete in the summer of 1994. Treatment type will be modified to conventional and reclaimed water disposal will remain the same.

Future:

The expanded facility is anticipated to be adequate to serve the build-out population of the service area. Disposal will be via the existing facilities.

Source:

Information provide by the Sanibel Sewer System and the City of Sanibel.

APPENDIX F

Wetlands and Environmentally Sensitive Areas

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FACTORS AFFECTING WETLANDS AND ENVIRONMENTALLY SENSITIVE AREAS

Factors which influence wetland systems and environmentally sensitive lands include hydrology, fire, geology and soils, climate, and ecological succession. This section presents an overview of each of these factors.

Hydrology

Hydrology is the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes (Mitsch and Gosselink, 1986). Hydraulic inflows and outflows, such as precipitation, surface runoff, ground water inputs, and in some cases, tides and river flooding, provide the energy to transport nutrients and other organic material to and from wetlands. Water depth, hydroperiod, flow patterns, stage, duration, frequency of flooding and water quality all influence the biochemistry of wetlands and ultimately, the species composition and type of wetland community that develops. The hydrology of a wetland acts both as a limit and a stimulus for determining the numbers, types (species), and growth rates of flora and fauna that can live within a specific wetland. For example, the growth rates of pine trees appear to be affected by water table depths. Slash pine growth rates in flatwoods generally increase in proportion to the depth to the water table, indicating the inhibitory effect of excessive moisture (Duncan and Terry, 1983). At the other extreme, tree growth can be limited by a lack of available moisture during the dry season (Haines and Gooding, 1983). Hydrology also strongly affects aquatic primary production, organic accumulation, and the cycling of nutrients (Mitsch and Gosselink, 1986).

Precipitation

The LWC Planning Area experiences wide variations in annual rainfall, resulting in flooding and extended drought periods. During heavy rainfall years, there is overland flow and discharge to the ocean. During extended drought years, however, the natural system is stressed by saltwater intrusion, increased frequency of fires, loss of organic soils, and invasion of wetlands by exotics. The region averages about 53 inches of rainfall annually, with approximately two-thirds falling during the summer months (Duever *et al.*, 1986). During the dry season (November-April), precipitation is governed largely by large-scale winter weather fronts which pass through the region roughly every seven days (Bradley, 1972). Rainfall from these fronts exhibit a uniform distribution pattern as compared to precipitation derived from the highly variable, convective-type thundershowers which are characteristic of the wet season (May-October).

Evapotranspiration

Evapotranspiration (ET) is the combined process of evaporation from land and water surfaces, and transpiration from plants. ET rates vary as a function of solar radiation, air and water temperature, relative humidity, wind velocity and duration and the type and density of vegetation (Duever *et al.*, 1986). In South Florida, ET ranges from 70 to 95 percent of annual rainfall. During the dry season and drought years, ET exceeds rainfall inputs (Klein *et al.*, 1975). Temperature is often regarded as the most important factor controlling ET. Minimum ET rates occur during the winter months of December and January, with highest values experienced during the spring months of April and May. Typical ET values for South Florida range from 40 to 45 inches a year, up to a maximum of 60 inches a year (Parker *et al.*, 1955). ET

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rates frequently account for virtually all water losses in a wetland because of their slow rate of flow and high surface area to depth ratio (Mitsch *et al.*, 1988). As a result, ET plays a very important role in the development of any hydrologic model that might be developed for a particular wetland system and is usually the most difficult parameter to estimate. Wetlands have higher ET rates than other habitats largely because they store water near the ground surface where it can be lost to the atmosphere (Duever, 1988).

Hydroperiod

Hydroperiod refers to the annual period of water level inundation, specifically the length of time (duration) that a wetland contains water above ground level. Figure F-1 presents examples of typical hydroperiods experienced by three different South Florida plant communities. Duever *et al.* (1986) reports that hydroperiod is the dominant factor controlling both the existence, plant community composition and succession of South Florida wetland systems. Hydroperiod is often expressed in terms of the range of the number of days that a wetland is normally inundated. For example, in the Big Cypress Preserve, Duever *et al.* (1986) reports that freshwater marshes are usually found on sites having a hydroperiod of 225 to 275 days per year, as compared to a pond system which is inundated year round. Each wetland type is thought to have a hydrologic signature that describes the rise and fall of water levels from year to year (Mitsch and Gooselink, 1986). Duever *et al.* (1986) found that work conducted at Corkscrew Marsh "has clearly shown that the distribution of undisturbed upland, marsh, swamp and shallow aquatic habitats are largely a function of a site's hydroperiod." In contrast, O'Brian and Ward (1980) state that from a hydrological point of view, the most significant feature of a wetland is the level of the ground water table. They point out that the depth to the ground water table is more significant than the hydroperiod or time the wetland is flooded.

Water Level Depth and Timing

In South Florida's freshwater wetlands, wading bird nesting success is highly dependent on present and past water level conditions, which influence the amount and availability of wading bird prey items, such as crayfish and small forage fish (Kushlan, 1976, 1978, 1979, 1980, 1986; Powell, 1987; and Frederick and Collopy, 1988). Ecological studies of Southwest Florida wetlands have found a direct relationship between numbers of wading bird breeding attempts and the amount of rainfall preceding the breeding season (Ogden *et al.*, 1980, 1987). Kahl (1964) found that the timing and initiation of wood stork breeding attempts was predictable from the measurement of marsh surface water levels. Kushlan *et al.* (1975) found that wading bird nesting success was directly related to the rapid winter/spring recession of water levels (drying rate) of South Florida wetlands. Therefore, maintenance of appropriate water depths and timing of wetland water level fluctuations is a critical factor in determining wading bird nesting success.

Topography

In general, wetlands in temperate and tropical regions tend to develop in areas of low topographic relief and high rainfall inputs. Topography also controls the shape and size of watersheds, and affects the timing and quantity of runoff. Topography is also an important factor in controlling the vertical and horizontal extent of seasonal water level fluctuations within a wetland. In the Big Cypress swamp, Duever *et al.* (1986) found that wetlands dominate much of South Florida because: (1) the flat topography reduces runoff to a minimum, (2) high rainfall during the warm part of

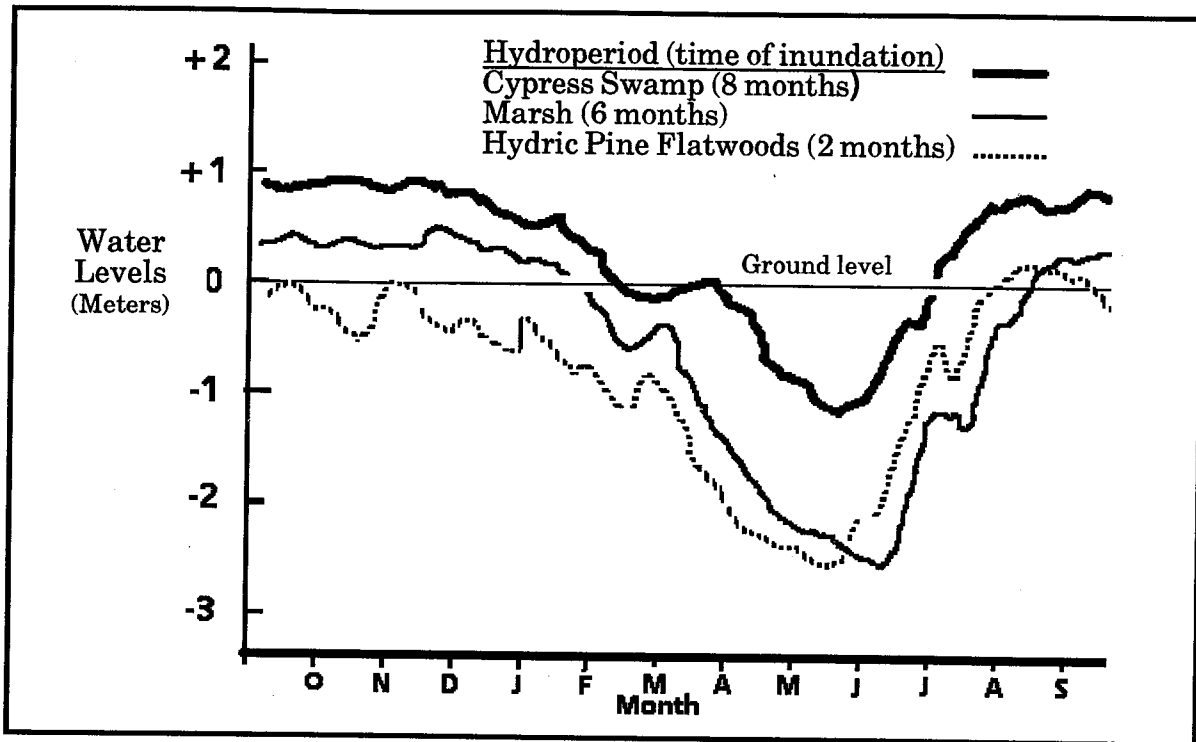


FIGURE F-1. Hydrographs and Hydroperiod Ranges for for Three Different South Florida Vegetation Types. (From Duever *et al.*, 1986).

the year compensates for high ET losses, and (3) low ET rates during the the cool part of the year approximates rainfall inputs. At the site-specific level, wetlands are determined by the depth and duration of inundation, which in turn are influenced by site microtopography (differences in water depth of only a few centimeters), soil type, and vegetation cover (Duever *et al.*, 1986).

Vegetation Type

Vegetation type can affect the hydrologic cycle of a wetland, primarily through ET. Vegetation also influences water movement and water quality. Plant leaves, leaf litter and attached periphyton (algae) communities tend to impede water flow which: (1) increases the period of inundation, (2) reduces surface water runoff and erosion, (3) allows more time for aquifer recharge, and (4) assimilates nutrients and chemical exchanges between the soil vegetation and water (Duever *et al.*, 1986).

Tropical Storms and Hurricanes

Hurricanes, tropical cyclones which generate winds in excess of 75 miles per hour, are recurrent events in South Florida and are important physical processes which affect the regional ecology (Craighead and Gilbert, 1962). Southwest Florida has been identified by the National Weather Service as one of the most hurricane-vulnerable areas of the United States. Hurricanes normally cause the greatest amount of damage when wind velocities average greater than 111 miles per hour. Such storms have passed within 100 miles of Fort Myers on the average of once every five-and-one-half years from 1900 to 1985 (SWFRPC, 1990).

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Coastal flooding from tropical storms or tropical depressions occur commonly within the LWC Planning Area, causing flooding in low-lying areas, along barrier islands, and near river and bay systems (SWFRPC, 1990). Although these storms are destructive to life and property, they appear to be an important component of the region's natural hydrological cycle, often occurring following several drought years to replenish surface and ground water sources. These storms also appear to be an important source of fresh water and nutrient inputs into Florida Bay (Meeder and Meeder, 1989).

Fire

Fire is also an important factor controlling the species composition, distribution and succession of wetland communities in the LWC Planning Area. Within the constraints of wetland hydrology, fires occur with variable frequency and severity affecting plant succession.

Theoretically, hardwood hammocks represent the climax plant community for South Florida (Alexander and Crook, 1973; Wharton *et al.*, 1977; Duever, 1984). Hammocks develop when fire is absent or infrequent, and organic soils are allowed to build up over time to support the succession of hardwoods (Figure F-2). However, fire is a common component of the South Florida landscape. In the Everglades, fires occur, on the average, every seven years. Few areas escape fire; thus hammocks are relatively uncommon and occur only on elevated sites where fire is infrequent. Most sites which are high enough to support hammocks are occupied by pine flatwoods which are tolerant of periodic fire (Duever, 1984).

Wetlands are subject to fires during the dry season. Marshes which dry out and burn with enough frequency do not allow the establishment of cypress forests. Cypress dominated wetlands occur on wetter organic soils which burn less frequently. Before man settled the region, the majority of fires were caused by lightning strikes during the wet season. As more people moved to the region, more fires occurred during the winter dry season. These fires are typically more severe and extensive since they occur during the dry season when wetland soils are dry.

Geology and Soils

The primary geological feature that controls regional hydrology is the permeability of the underlying rock. Limestone with deposits of quartz sand, clay and shell comprise the underlying aquifer. A more detailed description of the region's geology and underlying aquifer system is found in Chapter III.

Two primary factors which affect the hydrogeology of wetlands are the porosity and permeability of its underlying soils (Duever, 1988). A highly porous soil can hold or store large amounts of water, while a highly permeable soil allows water to flow to the underlying aquifer. The high capillary action of peat or clay soils enable wetlands to store large quantities of water, somewhat similar to how a sponge takes up water.

Some wetlands contain perched water tables. A perched water table exists where a saturated soil layer is found above a water table and is separated from it by an unsaturated zone (Freeze and Cherry, 1979). This can occur where a relatively impermeable clay or organic soil layer is present near the ground level and restricts the downward movement of water. Perched water tables come in various sizes and can influence surface water levels over large areas or have only local, temporary

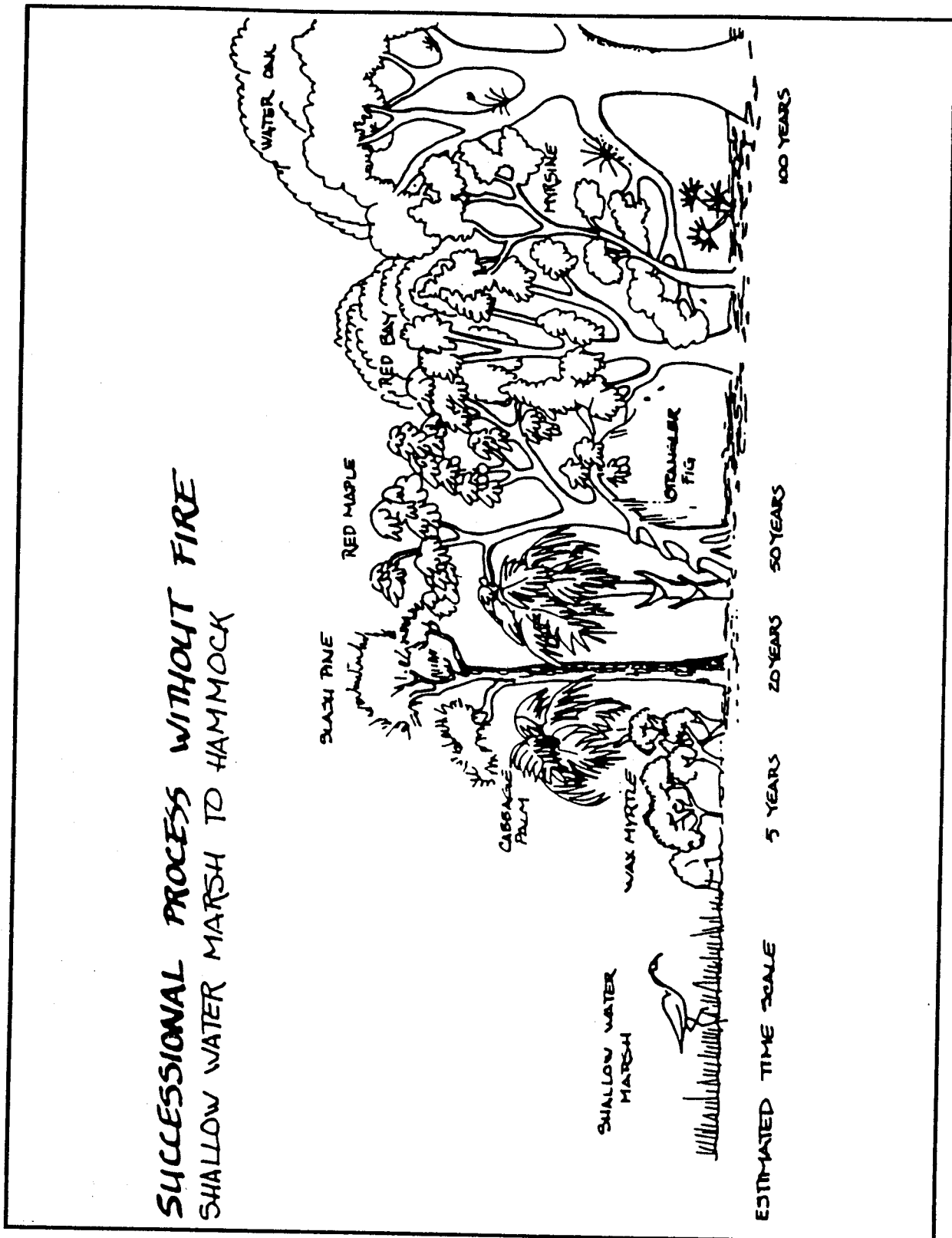


FIGURE F-2. South Florida Successional Pattern without Fire: Shallow Water Marsh to Hammock (From Wharton *et al.*, 1977).

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effects (Duever, 1988). A common misconception is that wetlands can only occur on sites containing a perched water table. Although this may be the case in some areas, Duever's (1988) experience in Southwest Florida indicates that wetland water levels coincide with the regional water table. Situations which at first appeared to be a perched water table turned out to represent unusual or transient conditions.

Climate

In addition to hydrology and fire, climate also plays an important role in controlling plant community succession. The areal extent, species composition, and existence of wetlands are all affected by long-term climatic changes. In addition to normal cyclic drought and flood conditions, long-term cycles have the ability to produce gradual, and nevertheless, major shifts in the normal year-to-year range of hydrologic conditions. As climatic cycles become wetter, wetlands will tend to cover larger areas of the landscape. Wetland communities would also tend to become more diverse as a result of the presence of greater ranges of hydroperiods on different topographic sites. A wetter climate might also increase the rate of peat accretion in wetlands, thus encouraging the development of edaphic plant communities. Long-term drier conditions might produce the opposite effects. A wetter or dryer climate might also affect the frequency of fire, shifting plant community succession. A major difficulty in managing wetlands is our inability to distinguish between shifts in hydrologic conditions that result from man's activities and those that result from occasional natural events or long-term shifts in climate (Duever, 1984).

Succession

Overdrainage of wetlands and reduction of hydroperiod length directly influences the direction of plant community succession within a wetland. McPhearson (1973) reported that "differences of only a few inches in depth or changes in period of inundation will determine, in time, what plant communities are present [in the Everglades]." Numerous investigators have documented changes in the species composition of South Florida plant communities resulting from altered water level conditions (Davis, 1943; Loveless, 1959; Kolipinski and Higer, 1969; Dineen, 1972, 1974; Alexander and Crook, 1973, 1988; Schortemeyer, 1980; Worth, 1983). Duever *et al.* (1976) used fire frequency and hydroperiod data to establish a basis for the occurrence of plant community succession in Corkscrew Swamp. This relationship is presented in Figure F-3. The successional relationships of South Florida wetland and upland plant communities have also been discussed by Alexander and Crook (1973), Craighead (1971), Davis, (1943), Wharton *et al.* (1977), and Duever, *et al.* (1986). These data are useful for making a general assessment of the direction that succession may take as a result of increasing or decreasing hydroperiod in a Southwest Florida wetland.

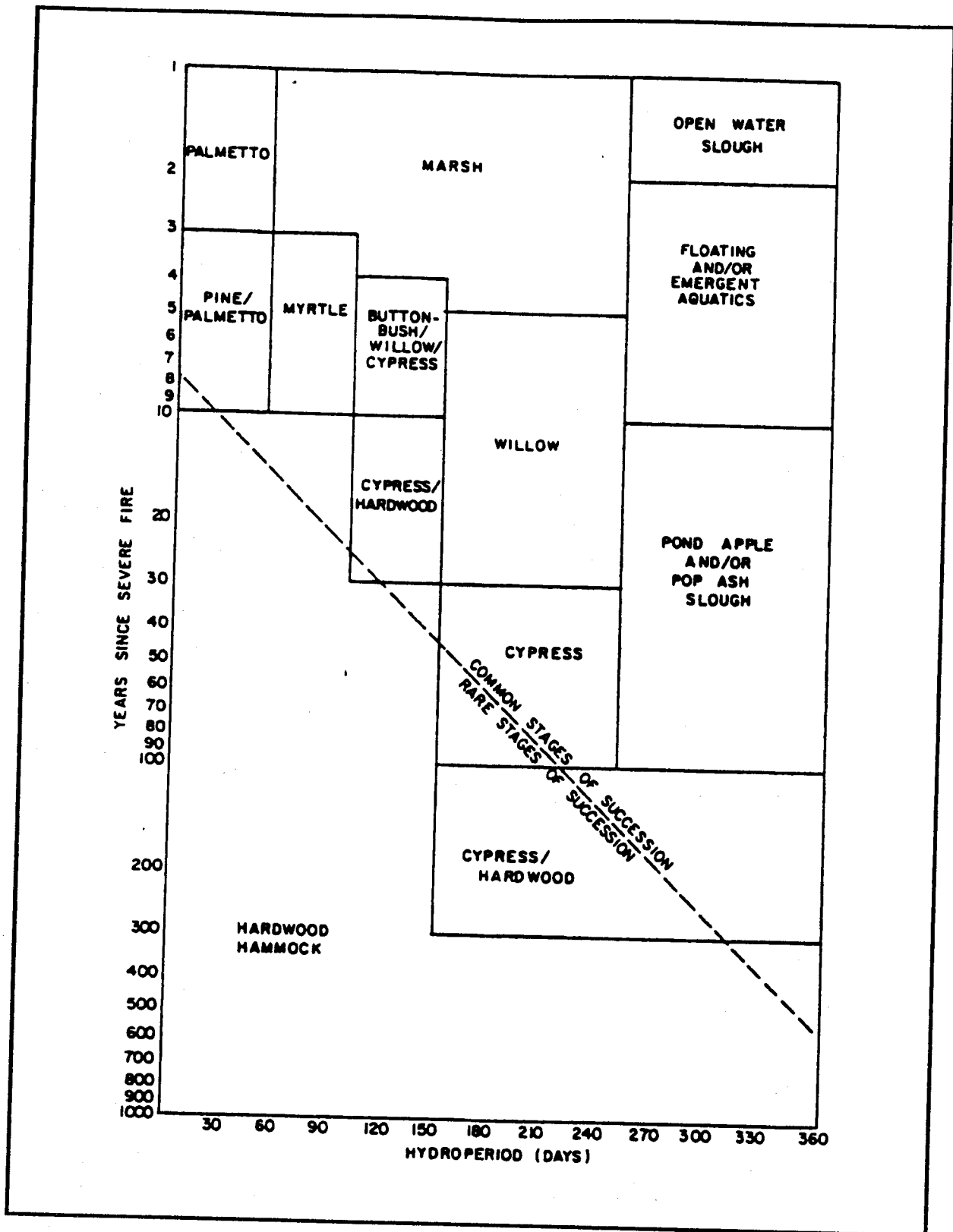


FIGURE F-3. Successional Patterns and Rates within South Florida Inland Plant Communities (From Duever *et al.*, 1984).

REGIONAL ENVIRONMENTAL ISSUES

Loss of Wetlands

According to the U.S. Fish and Wildlife Service (1990), Florida has lost over 9.3 million acres of wetlands between 1780 and 1985, a 46 percent loss. During the 1970s and 1980s, despite strict environmental regulations, Florida lost, on average, over 26,000 acres of wetlands annually, which is the equivalent of losing 70 acres of wetlands each day. Almost all of these losses are the result of conversion of wetlands to agriculture, urban and other built-up areas (Frayner and Hefner, 1991). It was estimated that in 1780, Florida had over 20.3 million acres of wetlands; the state now has less than 11 million acres. Florida's losses represent over 15 percent of the national loss annually (U.S. Congress, 1984).

In Southwest Florida, large-scale loss of wetlands occurred during the 1960s and 1970s. Urban and agricultural development has affected both the quantity and quality of remaining wetlands. In Lee County, continued urban growth has altered the county's natural systems over the past 50 years. In the northwest portion of the county, the peninsula now occupied by the City of Cape Coral originally consisted of sloughs, marshlands, and seasonal ponds. Almost all of this original habitat has been lost to development. Lehigh Acres, another large-scale residential development located in the eastern part of the county, has also resulted in the ditching and draining of thousands of acres of the original wetland/upland mosaic. Other parts of the county have been converted to cropland and improved pasture.

In Collier County, a single large development, Golden Gate Estates, attempted to drain 110,000 acres of pristine forested and emergent wetlands. This project dug 183 miles of canals, constructed 813 miles of roads, and sold over 50,000 individual lots to buyers worldwide (Frayner and Hefner, 1991). Construction of two primary canal systems, the Golden Gate Canal and the Faka Union Canals, disrupted natural drainage patterns and lowered ground water levels to control flooding and make land suitable for development (Klein *et al.*, 1970; Carter *et al.*, 1973; McPherson *et al.*, 1976). Along the coast of Collier County, south of Naples, a large resort community was built on Marco Island. Construction of this community converted approximately 5,300 acres of mangroves and uplands to finger canal subdivisions. Collier County has also experienced a large amount of growth along its northern coastal area. This growth has the greatest impact on the estuarine communities affected by the alteration of both the quantity and quality of the freshwater runoff they receive. Construction of Alligator Alley (State Road 84), Tamiami Trail (U.S. 41), I-75 and State Road 29 have all impacted historical surface water flow patterns throughout the LWC Planning Area. Heavy use of these roads is a threat to several species of endangered wildlife, including the Florida panther.

The Corkscrew Regional Ecosystem Watershed (CREW) lands represent more than 50,000 acres of environmentally sensitive wetlands and uplands located in Collier and Lee counties. The CREW lands contain five major wetland systems: (1) Flint Pen Strand, (2) Corkscrew Marsh, (3) Corkscrew Swamp Sanctuary, (4) Bird Rookery Swamp and (5) Camp Keis Strand. This area probably represents the largest remaining hydrologically intact wetland ecosystem in South Florida and provides important wildlife habitat to a number of rare, threatened and endangered species.

Potential impacts to CREW include: (a) the possibility of lowered ground water tables and impacts to wetlands as a result of county and municipal wellfield

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development within the watershed, and (b) lowered water table elevations, degraded water quality, and associated wetland impacts caused by the expansion of the citrus and vegetable industries. If properly managed, these lands have the potential to provide a number of benefits to the region. Preliminary data suggests that CREW may offer some degree of water supply for Lee and Collier counties, along with the potential for providing drainage, flood storage and water quality improvements for surface waters discharged to downstream estuaries. The District is currently conducting a hydrologic evaluation of the CREW watershed.

Developments of Regional Impact

Several large developments of regional impact are currently being considered for approval. These proposed developments have the potential to alter surface water flow patterns, deplete ground water supplies, cause alteration of wetland hydroperiods, encourage exotic plant invasion, and impact existing wildlife habitat.

Southwest Regional Airport Expansion

Lee County is currently planning to expand the existing regional airport located in the central portion of the county. Expansion plans call for runway improvements, construction of roads and parking lots, rental car and commuter aircraft parking, a new concourse and associated support facilities. This proposal would impact a minimum of 400 acres of wetlands (Memorandum dated November 12, 1991 from Chip Merriam, Government Assistance, SFWMD, Ft. Myers area office).

Alico DRI

The Alico DRI is an 11,000 acre conceptual plan to develop a 20,500 dwelling units, integrating a mix of industrial, commercial, office, residential, public open space, and recreational land uses. The project has the potential to impact 1,310 acres of wetlands, consisting primarily of cypress wetlands, freshwater marshes, and wet prairies. Environmental concerns focus upon: (a) potential drainage of wetlands and loss of wildlife habitat as a result of wellfield drawdowns, (b) impacts associated with drainage and development, (c) potential water quality impacts to the Estero River and Six Mile Cypress Basin, and (d) the encouragement of more urban sprawl within the central portion of the county, which has the potential to further fragment remaining wildlife habitat.

Gulfview-New Town

The proposed project is a 7,000 acre mixed residential and commercial development. Approximately 1,300 acres of property will be within the Flint Pen Strand as identified by the Save Our Rivers CREW Project. Lee County has proposed the establishment of several wildlife corridors within the county to reduce the detrimental effects of habitat fragmentation; one of these corridors is proposed for this project.

Relocation of Citrus to Southwest Florida

The conversion of upland and wetland habitat to citrus in Hendry County, western Glades, eastern Lee and Charlotte, and northern Collier counties is threatening the area's water resources and remaining wildlife habitat. In the early 1980s, a series of devastating freezes caused serious damage to Central Florida's citrus industry. As a result, many citrus growers have recently migrated to

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Southwest Florida, seeking to reduce the risk of freeze damages to their crop. This has resulted in a major shift in the geographical distribution of citrus within Florida.

Based on the number of trees in the ground, Hendry County now ranks as Florida's number one citrus county, and ranks third in total citrus acreage. Since 1980, citrus acreage in the region has nearly doubled to its current level of 126,000 acres (Table F-1). Much of this growth has occurred in the past three years (Behr, 1989). According to Florida Gulf Citrus News (1990), citrus growers within the Southwest Florida area planted over 7,000 citrus trees on 40 acres each day during 1988 and 1989. This trend is expected to continue through the next decade, with a projection of up to 80,000 hectares (197,680 acres) in citrus production by the year 2000 (Land, 1988). The on-tree value of this production is estimated to be \$380 million dollars annually, given current citrus prices (Behr, 1989).

TABLE F-1. Citrus Acreage and Trees, 1990.

COUNTY	ACRES	TREES
Hendry	73,754	10,387,900
Collier	23,565	3,204,100
Charlotte	11,718	1,241,000
Lee	9,692	1,169,300
Glades	7,523	890,000
Gulf Total	126,252	16,892,300

Source: Florida Gulf Citrus News, 1990.

Impacts on Wetlands

Citrus development requires extensive drainage of the land and lowering of the water table during the wet season to support the growth of crops. Much of the east-central portion of the LWC Planning Area is currently cattle rangeland (improved and unimproved pasture and native rangeland). The drainage requirements for rangeland, however, are significantly different from those required to operate a citrus grove. Pasture and rangeland are typically drained by shallow ditches placed at wide intervals because native grasses can survive long periods of flooding. In contrast, citrus groves are very sensitive to saturated water table conditions and require rapid drainage. As a result, the typical citrus operation requires a rather elaborate and responsive drainage/irrigation system, which includes high capacity wells, pumps, reservoirs, ditches, levees and dikes. Impacts caused by the drawdown of the water table beneath adjacent wetlands is a concern as the industry expands its operation within the region (University of Florida, IFAS, 1991).

Impacts on Uplands

There is a concern that the magnitude and scale of citrus development has the potential to replace most of the remaining upland communities such as flatwoods and xeric scrub habitats which are native to the region. Conversion of large areas of uplands to citrus within Hendry, Lee and Collier counties may significantly affect the regional ecosystem and its remaining wildlife habitat, which borders two federally protected areas (i.e., the Big Cypress National Preserve, Everglades National Park,

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and the Florida Panther National Wildlife Refuge). Some of this development is occurring in areas occupied by threatened or endangered species such as the Florida panther, black bear, red-cockaded woodpecker, gopher tortoise, gopher frog or Florida scrub jay. As illustrated in Figure F-4, much of the Florida panther's range is threatened by citrus development.

Large-scale citrus development is also a source of concern for the natural hydrology of the area. The pumpage capacity required to efficiently operate a typical citrus grove can produce large distortions in the predevelopment surface water hydrology of surrounding areas, thus affecting adjacent wetlands as well as hydric hammock and hydric pine flatwoods areas. Drainage of uplands and wetlands, and loss of surface water storage areas, may also affect ground water recharge rates and impact future water supplies. In addition, significant amounts of fertilizers and pesticides are used in the operation of a typical citrus grove. These contaminants have the potential to be transported off site in drainage waters to downstream receiving waters. Relatively little is known concerning the water quality impacts of a citrus grove operation on adjacent land uses or water bodies.

Impacts of Ground Water Drawdowns on Wetlands

Expansion of existing county and municipal wellfields in central Collier, southeastern Lee and Hendry counties, and the associated effects of lowering regional ground water tables is a concern for existing wetland systems within the LWC Planning Area.

Relatively little information exists which describes the impact of large-scale agricultural wellfield drawdowns on wetland systems in the LWC Planning Area. Regulatory agencies, such as the SWFWMD, face a difficult problem in developing scientific rationale for quantifying the effects of ground water pumpage on wetlands (Watson, 1990), specifically the depth which the water table can be lowered before an impact can be detected within a wetland. The majority of available information presented below has been derived from municipal wellfield drawdown studies.

The effects of municipal wellfield drawdowns on wetlands have been well documented by the Southwest Florida Water Management District (Rochow, 1982, 1983, 1984, 1985; Rochow and Dooris, 1982; Dooris *et al.*, 1990; Watson *et al.*, 1990; Rochow and Rhinesmith, 1991). Over a 15-year period, the SWFWMD has produced more than a dozen technical reports from their wellfield monitoring program concerning the effects of ground water withdrawals on wetland ecosystems. In general, these data indicate that long-term wellfield drawdowns greater than one foot result in "unacceptable ecological change" to wetland communities. These changes (from Dooris *et al.*, 1990) include:

- Invasion or establishment of terrestrial plant species creating a "disturbed" appearance and potentially allowing for invasion by exotics
- In severe cases, lowered water table elevations have caused cypress tree mortality and loss of canopy cover
- Increased susceptibility to damage by fire and increased numbers of destructive fires causing changes to community structure
- Loss of organic soils and increased soil subsidence.
- Loss of wildlife habitat and wildlife resources.

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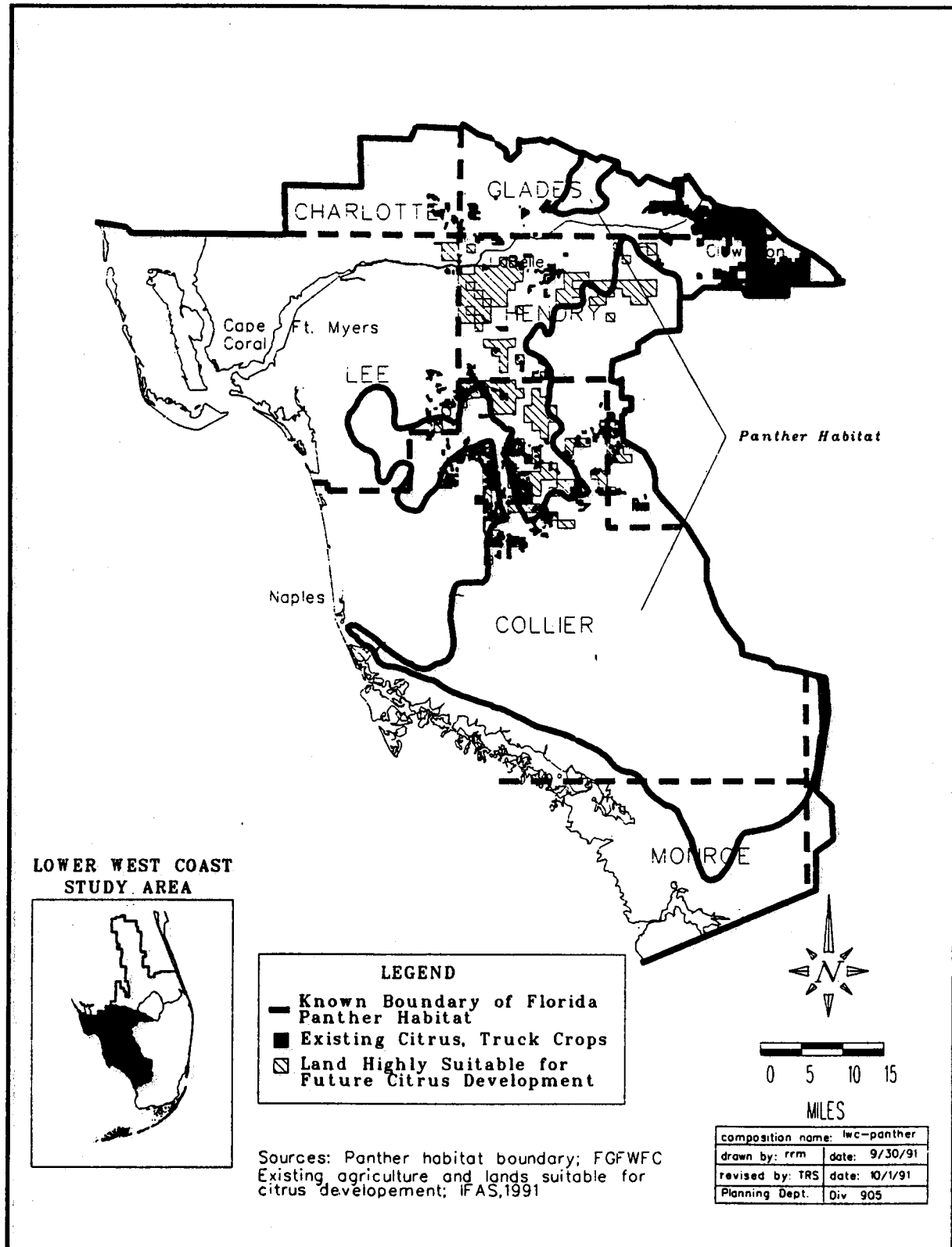


FIGURE F-4. Florida Panther Habitat and Permitted Citrus in Southwest Florida.

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Hydrological and biological monitoring of the Starkey Wellfield has shown that a 0.6 foot water table drawdown corresponded to a noticeable replacement of wetland plant species with those more adapted to upland sites (T.F. Rochow, 1989).

In the LWC Planning Area, relatively little work has been directed towards determining the effects of wellfield drawdowns on wetland ecology. The majority of available information has focused upon the ecological impacts of lowered water tables caused by drainage canals. In a study of the Big Cypress Swamp, Carter *et al.* (1973) described the impacts to cypress wetlands from drainage. Burns (1984) studied the effect of declining water levels within a Fakahatchee Strand cypress community. Results showed that lowering of the water table by an average of 50 cm (1.6 ft.) significantly decreased biomass and net production of the cypress strand. Within this same strand system, Carter *et al.* (1973) and Burns (1984) found a tenfold decrease in primary productivity, extensive thinning of the cypress forest canopy, and a reduction in the rate of forest litter decomposition, leading to buildup of fuel for destructive wildfires. Related observations in the Big Cypress Swamp indicate that extensive dewatering of certain areas of the swamp over the past three decades has led to widespread invasion of cypress communities by slash pine, red maple and red bay. In areas that were previously lumbered and burned, willow is the dominant canopy species for decades to come (Duever *et al.*, 1984). In southeast Florida, recent data published by Hofstetter and Sonenshein (1990) showed vegetative changes that occurred from 1978 through 1986 in an Everglades wetland (Northwest Wellfield, Dade County). Results of the study show that wellfield drawdowns shorten hydroperiod, decrease herbaceous marsh vegetation in favor of woody vegetation and allow for invasion by melaleuca.

Loss of Aquatic Productivity

Wetlands are known as one of nature's most productive ecosystems. For the greater portion of the year, wetlands are flooded and therefore function essentially as an aquatic system. Typically, 75 to 85 percent of the annual precipitation occurs during the months of June through October. Since Southwest Florida wetlands depend upon rainfall as their major source of inflow water, water levels within wetlands systems closely follow seasonal rainfall patterns. Maximum water levels occur near the end of the wet season (October - November) while water levels generally decline during the dry season, reaching lowest levels during April and May. The majority of animals which inhabit Southwest Florida are adapted to this annual cycle. The reproductive success of several key species is closely tied to the rate of water level recession and the concentration of food resources that occurs during the dry season (Ogden *et al.*, 1987; Robertson and Kushlan, 1974).

The presence of surface water within a wetland is essential for maintaining wetland aquatic productivity, i.e., the growth and reproduction of aquatic organisms such as insects, small forage fish, amphibians, crayfish, freshwater shrimp, snails and other invertebrates that form the basis of the food chain for higher trophic level organisms such as amphibians, reptiles, wading birds and raptors which utilize these wetlands (Kahl, 1964; Kushlan, 1976, 1978; Frederick and Collopy, 1988). Overdrainage of wetlands by ground water withdrawals or surface drainage directly impacts this annual cycle by reducing wetland size, as well as the amount, number and kinds of microorganisms produced by wetlands. Therefore, large-scale drainage of wetlands has a great potential to impact the regional food supplies, breeding and nesting areas for many species of wildlife.

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Decrease in Wetland Size

The most obvious impact of reducing water levels is a decrease in size of the wetland. This is especially true of shallow, low gradient wetlands which may be completely eliminated. Decrease in wetland size reduces the available wildlife habitat and the area of vegetation capable of nutrient assimilation. It also reduces the water surface area, and corresponding ET and evaporation rates, which can have an influence on the rain cycle and regional climatic conditions.

Degradation of Fish and Wildlife Habitat

A decrease in wetland size reduces the available wildlife habitat. The accompanying changes in vegetative composition and diversity, and loss of aquatic productivity impacts the breeding and nesting areas for many species of wildlife.

Invasion by Exotic Plants

Invasion by exotic plants such as melaleuca and brazilian pepper is encouraged by changes in the depth and/or duration of wetland water levels. Melaleuca adapts well to alternating flood and drought conditions, and can form thick, monotypic stands that have very little wildlife value. Melaleuca also exhibits a high rate of ET and is very tolerant of fires, sprouting readily from the root stock after burning. The threat from this aggressive and difficult to control species argues strongly against allowing any further decreases in water levels or hydroperiods in the wetlands.

Alteration of Historical Surface Water Flows

Changes in water levels can also affect surface water flow patterns within and between wetlands. Reductions of the amount of surface water flow from wetlands can also have a negative effect on the salinity balance in estuarine habitats. This can be detrimental to the productivity of seagrass beds, oyster bars, and other valuable coastal environments.

Soil Subsidence and Increase in Fire Potential

With the impact on wetland water budgets that occurs from wellfield drawdowns comes an increase in the frequency and severity of wildfires. Fires are part of the natural process that recycles nutrients from accumulated plant material back into the soil. They are prevalent in the dry season, especially during drought years. Normally, the soil remains wet almost to the surface, protecting the roots of wetland vegetation from damage. When the water table is depressed to unnaturally low levels, the muck soils that underlay many of South Florida's wetlands dry out and become flammable. Resulting muck fires kill natural wetland vegetation, which is replaced by less desirable, weedy species. Even in the absence of fire, overly drained muck oxidizes and breaks down, which can lead to vegetation changes and degradation of wetland function.

Saltwater Intrusion

Wetlands in coastal areas may experience vegetative changes in response to salinity changes. For example, cypress, maple, and other freshwater species can be killed by increased salinity resulting from decreased inflows of fresh water. One way to deal with this situation would be to establish minimum flows, which could lead to constraints on water supply development upstream.

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Other Impacts

There are numerous other activities which affect wetlands that are outside the scope of this report, but may contribute to the cumulative impact on wetland systems (Larson, 1976; Carter *et al.*, 1973; University of Florida, Center for Government Responsibility, 1982; Rochow, 1989; CH₂M Hill, 1988):

- Outright filling and conversion to residential, commercial, industrial, or agricultural uses
- Drainage for pasture
- Rock mining
- Peat mining
- Chemical or biological pollution
- Impounding
- Dumping
- Recreational misuse and overuse
- Noise pollution

Impacts of Ground Water Drawdowns on Uplands

Little is currently known about the hydrologic requirements of upland communities. However, it is known that the water table levels beneath an upland play an important role in defining the vegetative structure and composition of an upland community. Impacts to uplands from water table withdrawals are similar to those encountered by wetlands, such as increased frequency of fire caused by reduced moisture conditions stemming from lower than normal water table elevations. Most natural environments in South Florida depend on appropriate fire regimes to maintain their ecological integrity. Those upland communities that are on the highest and lowest water tables may prove to be the most sensitive to water table level change. Monitoring of upland parameters is needed to provide a better understanding of wetlands.

Impacts of Ground Water Drawdowns on Estuarine and Marine Habitats

Although estuarine and marine habitats are not specifically addressed in the water supply model developed for the LWC Water Supply Plan, these sensitive environments need to be considered whenever management scenarios have the potential to affect freshwater releases to tidewater. The degree of salinity as well as volume, distribution, circulation, and temporal patterns of freshwater discharge all contribute to the character of these systems. In many ways, salinity is a master ecological variable that controls important aspects of community structure and food web organization in coastal systems (Myers and Ewel, 1990). Salinity patterns affect productivity, reproduction cycles, population distribution, community composition, predator-prey interactions, and food web structure in the inshore marine habitat. Disruption of the food web resulting from a salinity imbalance would also have a detrimental impact on commercial and recreational fishing industries. Other aspects of water quality, such as turbidity, dissolved oxygen content, nutrient loads, and toxins also affect functions of these areas (Environmental Coalition of Broward County, 1987; U.S. Department of Agriculture, 1989; Myers and Ewel, 1990).

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Impacts on Wading Birds

The interior freshwater marshes of South Florida are important habitats because of their importance as feeding and nesting areas for a number of endangered or threatened species (wood stork, sandhill crane), or species of special concern (little blue heron, snowy egret, Louisiana heron, least bittern, limpkin). The future of these species is ultimately linked with maintaining healthy, viable wetland systems (Ogden, 1978).

Wading bird species commonly feed upon small fish (1 to 6 inches long) in waters typically 6 to 10 inches deep. Although wood storks and white ibis display different feeding techniques, both species are tactile foragers, meaning they feed by touching prey with their bill and swiftly snapping it shut to catch food. This specialized feeding technique requires a greater concentration of fish than needed by other wading birds, which feed primarily by sight. Therefore, wood stork and white ibis foraging success is affected in situations where total numbers of available fish are reduced as a result of wetland drainage or altered hydroperiods, as compared to wading bird species which feed primarily by sight.

Populations of wading birds have experienced large declines in South Florida. Factors which have led to decreased population levels include loss of habitat, alteration of historical water levels and hydroperiod, increased fire frequency, and overhunting. In some cases, species which inhabit wetland areas have been adversely affected by water management actions which were intended to provide for their protection.

Robertson and Kushlan (1974) estimated the total population of wading birds to be as high as 2.5 million in 1870, declining to less than 500,000 in 1910 as a result of plume hunting. Restrictive hunting legislation enabled populations to increase to an estimated 1.2 million by 1935. Since that time, total populations have declined to levels about 10 percent of the levels recorded during the 1930s (Collopy and Federick, 1986). Ogden (1978) states that the rapid decline in wading bird populations over the last three to four decades is the result of repeated nesting failures caused by inadequate food production. This can be attributed to marshland destruction and altered hydroperiods. Lowered water levels cause shortened reproductive periods for fish and aquatic invertebrates, and increase the frequency of destructive fires. Unusually high water levels during the nesting season cause food resources to be dispersed and unavailable during the critical nesting season.

The status of the endangered wood stork is of particular concern because it nests within the LWC Planning Area (Corkscrew Swamp). Historical populations of wood storks have sharply declined in South Florida. This decline is estimated to be about 80 percent between 1960 and 1980 (Ogden *et al.*, 1987). Population levels averaged about 2000 pairs until 1960, although much variation occurred (Robertson and Kushlan, 1974; Ogden *et al.* 1987). Numbers continued to decline during the 1970s and 1980s after construction of water management structures which delivered water to Everglades National Park (Ogden *et al.*, 1987). Ogden *et al.* has argued that the decline of wading bird populations within Everglades National Park was the result of alteration of the timing and distribution of surface water discharged into the Everglades since the 1960s. The authors indicate that the new water delivery schedule regime resulted in delayed and incomplete dry season drawdowns, which delayed wood stork nesting to the point where the nesting period extended into the wet season, and the adults could no longer obtain a sufficient concentrated food supply to support their young. Water management actions which allowed flood

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releases to the Everglades reversed the annual cycle of declining water levels and dispersed prey concentrations. Loss of peripheral wetlands, due to urban and agricultural development, is also thought to be the a major factor for nesting failures of many wading bird species.

Impacts on Rare, Threatened, or Endangered Species

Loss of habitat and habitat fragmentation are the major causes of the decline in a number of listed rare, threatened or endangered (RTE) wildlife species in South Florida. Reduction in population is due largely to conversion of natural habitats to agricultural and urban uses. Some species, such as the Florida panther and black bear, require large expanses of land to successfully survive as a breeding population. Other species are restricted to one particular type of habitat, such as the Florida scrub jay (pine/oak scrub) or red-cockaded woodpecker (mature pine flatwoods). Listed RTE species within the LWC Planning Area depend on both wetland and upland communities for survival. For example, the Florida panther inhabits uplands, but it frequents wetlands. The reverse is true for other species, such as the wood stork.

Agricultural and urban development have gradually fragmented and reduced the quality and size of existing wildlife habitat. Continued fragmentation of upland and wetland ecosystems has the potential to cause problems for the survivorship of many species. Table F-2 presents a list of the rare, threatened, and endangered species and species of special concern that are found within the LWC Planning Area. The following is a summary of selected species listed in the table.

Florida Panther (*Felis concolor coryi*)

A federally listed endangered species, the Florida panther has been given a high priority status to be saved through the Florida Panther Recovery plan (U.S. Fish and Wildlife Service, 1987). The panther requires a large territorial range, which is rapidly disappearing due to the expansion of agricultural and urban developments. This continued "loss and fragmentation of native landscapes in Southwest Florida will reduce the ability of panthers to function normally and will exacerbate problems associated with low numbers" (Maehr, 1990). Maehr also observed that while wetlands are an important habitat to panthers, they appear to prefer native upland forest habitats in Southwest Florida. The survival of the panther is closely correlated to the preservation of large tracts of contiguous and suitable habitats. Additional habitat losses may be incurred by changes in the hydrology of wetlands and uplands due to drawdown effects from wellfield operations.

Red-Cockaded Woodpecker (*Picoides borealis*)

Also a federally listed endangered species, the red-cockaded woodpecker was once common in the region within mature pine forest habitat. However, logging for timber and clearing for agriculture has significantly reduced this habitat, affecting the woodpecker population size and range. This woodpecker is the only woodpecker species to excavate a nesting cavity in a mature living pine tree, and therefore requires a mature stand of pines for successful nesting. In addition, the woodpecker lives in groups, referred to as clans, that may be as large as nine individuals. Their territories vary in size up to 250 acres, with areas of utilization up to 1000 acres. Soils which support mature pine forests are subject to conversion to agriculture and urban development. Hydrological changes from wellfield development may cause the further loss of pine forest habitat by increased fire frequency.

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Florida Scrub Jay (*Aphelocoma coerulescens*)

The Florida scrub jay is a threatened species that lives within a very restricted habitat range, permanently residing in upland scrub communities. These scrub communities exist on historic sand dunes, and are vanishing due to urban developments and conversion to citrus groves. The protection of this habitat is critical for species survival.

Gopher Tortoise (*Gopherus polyphemus*)

A species of special concern, the Gopher tortoise lives in a variety of habitats. The major cause for decline of tortoise populations has been the conversion of native habitat to agriculture and urban development. In the process of clearing the land, the tortoise is often killed by suffocation due to burial within their burrow. Highway mortality also significantly contributes the decline of this species in Lee County (Lee County, 1989). Gopher tortoise burrows are also utilized by over 80 different wildlife species, such as the Eastern Indigo snake (threatened species) and the Gopher frog (species of special concern).

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TABLE F-2. Selected, Threatened, Endangered, and Species of Special Concern within the Lower West Coast Planning Area.

SPECIES	FGFWFC	USFWS
<u>Amphibians and Reptiles</u>		
American alligator <i>Alligator mississippiensis</i>	SSC	T(S/A)
Eastern indigo snake <i>Drymarchon coralais couperi</i>	T	T
Gopher frog <i>Rana aerolata</i>	SSC	UR2
Gopher tortoise <i>Gopherus polyphemus</i>	SSC	UR2
Florida pine snake <i>Pituophis melanoleucus mugitus</i>	SSC	UR2
<u>Birds</u>		
Audubon's crested caracara <i>Polyborus planus audubonii</i>	T	T
Bald eagle <i>Haliaeetus leucocephalus</i>	T	E
Burrowing owl <i>Athene cunicularia</i>	SSC	
Florida sandhill crane <i>Grus canadensis pratensis</i>	T	
Florida scrub jay <i>Aphelocoma coerulescens</i>	T	T
Limpkin <i>Aramus guarauna</i>	SSC	
Little blue heron <i>Egretta caerulea</i>	SSC	
Osprey <i>Pandion haliaetus</i>	SSC (Monroe Co.)	
Red-cockaded woodpecker <i>Picoides borealis</i>	T	E
Roseate spoonbill <i>Ajaia ajaja</i>	SSC	
Snowy egret <i>Egretta thula</i>	SSC	
Southeastern American kestrel <i>Falco sparverius paulus</i>	T	UR2
Tricolored heron <i>Egretta tricolor</i>	SSC	
Wood stork <i>Mycteria americana</i>	E	E

E = Endangered.

T = Threatened.

SSC = Species of Special Concern.

UR2 = Under review for listing, but substantial evidence of biological vulnerability and/or threat is lacking.

T(S/A) = Threatened due to similarity of appearance.

Source: SWFRPC, 1990.

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TABLE F-2. (Continued).

SPECIES	FGFWFC	USFWS
<u>Mammals</u>		
Big Cypress fox squirrel <i>Sciurus niger avicennia</i>	T	UR2
Everglades mink <i>Mustela vison evergladensis</i>	T	UR2
Florida black bear <i>Ursus americana floridanus</i>	T	UR2
Florida mouse <i>Peromyscus floridanus</i>	SSC	UR2
Florida panther <i>Felis concolor coryi</i>	E	E
Round-tailed muskrat <i>Neofiber alleni</i>		UR2
West Indian manatee <i>Trichechus manatus</i>	E	E

E = Endangered.

T = Threatened.

SSC = Species of Special Concern.

UR2 = Under review for listing, but substantial evidence of biological vulnerability and/or threat is lacking.

T (S/A) = Threatened due to similarity of appearance.

Source: SWFRPC, 1990.